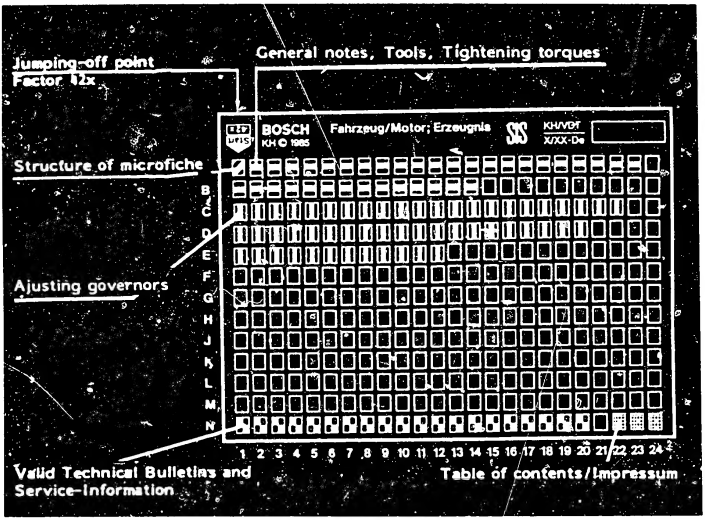
Structure of microfiche



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/assembly/test step Vehicle/engine	

Coordinate

3. Limits of section

Beginning — Mid-section — End — One-page section

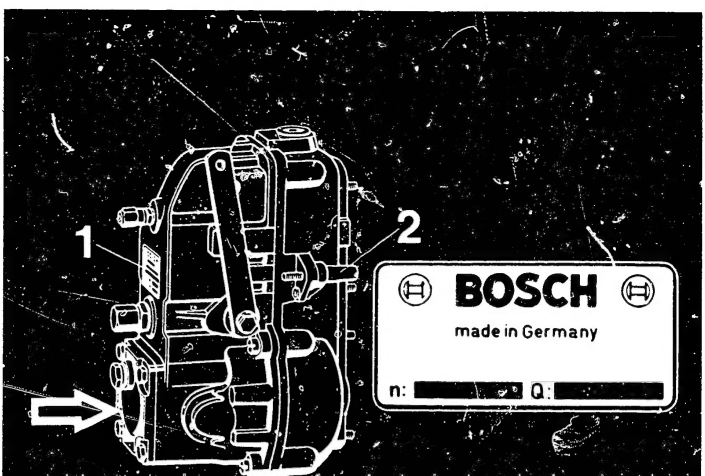
1. NOTES ON THE TESTING OF GOVERNORS

1.1 General notes

The test instructions contain all important instructions and information necessary for the adjustment of governors of series RSV for fuel-injections pumps of sizes A, MW and P, as well as RSUV for size P.
The sequence in which the operations are described is the same as the sequence in which the test specifications are given. The stated fuel deliveries are always the average of all plunger-and-barrel assemblies of a pump. The specified difference between fuel deliveries applies to the individual plunger-and-barrel assemblies of a pump.
Specified control-rod travels are adjusted and measured with the appropriate control-rod-travel measuring device. Checking values for engine speeds, fuel deliveries and difference are given in parentheses. These values apply only to the injection-pump assembly as received and may under no circumstances be used for resetting the pump. The encircled figures, e.g. 1 , refer to where the corresponding test specifications or setting values are listed in the previously used test-specification sheets.

1.2 Test specifications

The test specifications for fuel-injection equipment are contained in the test specifications on microcards WP.. (table of contents WP-00).
The collected test specifications for governors and timing devices alone are listed on microcards WP-451 to WP-453.



1 = Nameplate with changed data
2 = Max.-speed (full-load speed) stop
Arrow = Change of full-load delivery and sealed cover

1.3 Additional nameplate stamped with full-load deliveries and full-load speeds

Any customer-requested change from the test specifications must be stamped on the nameplate of the governor at

n = ... changed speed and
Q = ... changed full-load delivery

This applies both to new changes and to repairs during which such a change is upheld when setting. Proceed therefore in accordance with the specified instructions.

1.4 Special cases

MWM (special nameplate)

N = speed(s) to be set
Q = specified full-load delivery/deliveries
c = spring constant of torque-control spring
V = Preload of torque-control spring

(Earlier nameplates had only one speed and one full-load delivery.)

c = 6 means: Spring compressed by 1 mm results in 6 kgf increase in spring force.

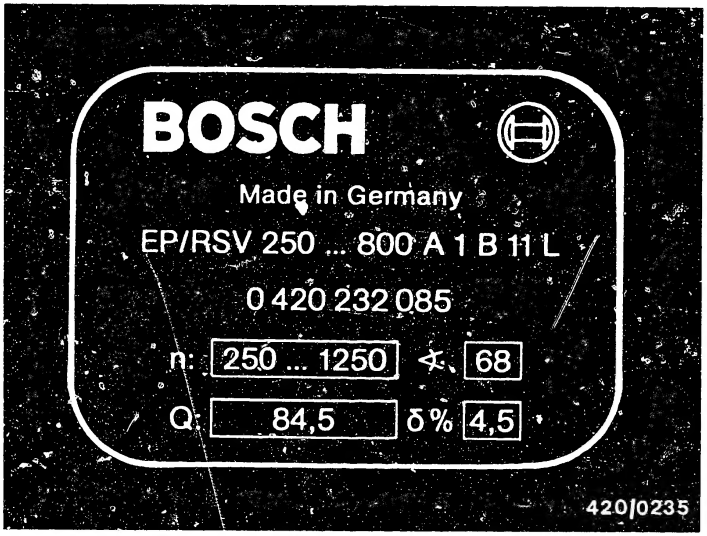
Ready-set spring retainers can be obtained from MWM by quoting c and V.

This special setting of the governor and of the full-load deliveries and speeds in accordance with data on nameplate corresponds to the required power output of the engine:

Therefore, after adjusting the governor spring, set the speeds and deliveries given on the nameplate.

If given, the second speed and the second delivery are set with the torque-control capsule.
If earlier test-specification sheets fail to give this second delivery, adjust the torque-control capsule until a change in the control-rod travel is detectable. No delivery is measured.

Make the other adjustments as given above.



Volvo-Penta and Scania
(special nameplate)

Some EP/RSV governors are re-adjusted by the customer to suit the application of the engine. To enable these changed governors to be set when repairs are carried out, they have a special nameplate.

Apart from the designation of the governor, the following are stamped on the free fields: The changed speed (n), full-load delivery (Q), control-lever position (angle°) and speed droop (delta %).

These governors are tested as follows:

Set the control-lever position (angle) given on the nameplate.
Bring the maximum-speed stop into contact and provisionally lock with lock nut.

3. Leave control-lever position and, by means of notched screw, adjust the governor spring so that speed regulation begins at approx. 20 min^{-1} above the maximum full-load speed given on the nameplate.

4. Set the full-load delivery given on the nameplate at a speed 20 min^{-1} below full-load speed. Then check speed regulation again and, if necessary, adjust with notched screw.

5. Set speed droop (δ) as per nameplate:
Set control lever to "MAX". Slowly raise speed, watching the control rod. Continue to raise speed slowly until the control-rod travel is reduced by precisely 6.0 mm from the full-load position. The speed difference between the precise breakaway (start of speed regulation) and reaching the 6.0 mm shorter control-rod travel represents approximately the speed droop in %.

Example:

Known:	Max. full-load speed:	1250 min^{-1}
	Full-load control-rod travel:	12.0 mm
	Required speed droop:	4.5 %

The required speed difference corresponding to 4.5 % between control-rod travel 12.0 mm and control-rod travel 6.0 mm is calculated as follows:

$$\frac{1250 \times 4.5}{100} = 56.25$$

The speed difference must therefore be 56 min^{-1}.

If this calculated speed difference is not obtained, the position of the control lever can be changed slightly. However, it is also necessary to re-adjust the speed regulation at the notched screw to approx. 20 min^{-1} above full-load speed.

This work corresponds to operations 1, 2a, 2b and 6 in the test specifications. Carry out the other adjustments as given above.

Case, USA, special setting

Testing of governor and setting of fuel delivery
(Section B on new test-specification sheets and Sections B and C on old test-specification sheets)
The following special setting is performed on the equipment of the above-mentioned company:

1. Adjust governor spring.

2. Preset full-load delivery/full-load control-rod travel. Reduce full-load control-rod travel by 1.0 mm by screwing back the full-load stop screw.

3. Screw in the torque-control capsule until the full-load delivery is again obtained.

4. Check torque control and fuel delivery characteristic

5. Check idle and adjust idle stop.

6. Check maximum full-load speed. Check high idle and set engine speed limitation.

7. Check starting fuel delivery.

1.5 Calibrating oil

The calibrating oil must conform to ISO standard 4113. It must not be mixed or contaminated with lubricating oil or diesel fuel from the fuel-injection pump since this will influence the measured values.

The admixture of other constituents might otherwise lead to the formation of an ignitable gas-air mixture and possibly to an explosion.

The specified calibrating oil temperature for in-line pumps is +38...+42°C in the inlet.

If using the continuous injected-quantity measuring system (KMM), the ambient temperature must not exceed +40°C.

Testing the viscosity:

Test equipment:
- Collector vessel with lid
- Thermometer with protective tube and holder — KDEP 1500
- Viscosity test beaker
- Stopwatch (not included)

Inspection intervals (depending on frequency of use of test bench)

- 1 x per week (according to ISO standard 4008/III).
- no later than after testing 20 injection pumps or after approx. 35 hours of operation.
- after no later than 6 months if, in the meantime, no injection pumps or less than 20 have been tested.

Preparations

Fill collector vessel approx. 3/4 full with filtered calibrating oil from the test bench inlet line. Ensure utmost cleanliness. Even minute particles of dirt (e.g. fluff in the collector vessel) will falsify the measurements.

Mount thermometer with protective tube on inside of vessel. Immerse viscosity test beaker in calibrating oil and leave in the calibrating oil for approx. 15 minutes. This ensures temperature equalization between viscosity test beaker and calibrating oil.

Testing

Using the chain, pull viscosity test beaker briskly (within approx. 1 sec) out of the calibrating oil (do not swing, keep steady in order to prevent loss of contents).

Start stopwatch when the viscosity test beaker emerges from the calibrating oil.

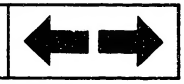
When the calibrating oil from the funnel-shaped region of the test beaker enters inside into the test beaker bore, stop stopwatch, read off discharge time and note.

Repeat visosity test until identical measurement (tolerance ± 0.3 s) is obtained.

If an identical result has not been obtained after the 4th repeat, there is dirt (e.g. fluff) in the viscosity test beaker, the collector vessel or the calibrating oil (filter in test bench). See section on Preparations. After this, repeat the test again, as described.

Compare measurement result with values in table.

If the measured time is not within the allowable discharge time tolerance, change the calibrating oil and the calibrating oil filter in the pump test bench.



Oil temperature in °C	Allowable discharge time (sec)
10	82.0 ... 89.5
11	81.0 ... 88.5
12	80.5 ... 87.5
13	80.0 ... 86.5
14	79.0 ... 86.0
15	78.5 ... 85.0
16	78.0 ... 84.0
17	77.5 ... 83.0
18	77.0 ... 82.0
19	76.5 ... 81.5
20	75.5 ... 80.5
21	75.0 ... 79.5
22	74.5 ... 79.0
23	74.0 ... 78.0
24	73.5 ... 77.5
25	73.0 ... 77.0
26	72.5 ... 76.0
27	72.0 ... 75.5
28	71.5 ... 75.0
29	71.0 ... 74.5
30	70.5 ... 74.0

Cleaning the viscosity test beaker

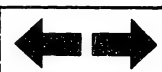
Do not clean the inside of the viscosity test beaker by polishing, but after each test wash out with benzine in order to prevent resin deposits in the outlet bore.

Never clean the outlet bore with a needle since score marks in the bore would falsify the measurement result due to a change in the flow conditions.

1.6 Condition of test equipment

The injection pressure of the calibrating nozzle-and-holder assemblies and the condition of the nipples of the calibrating fuel-injection tubing (use limit gauge) should be checked once a week, and no later than after testing 20 injection pumps.

If necessary, re-adjust opening pressure of nozzle holders and repair/replace fuel-injection tubing.



1.7 Test equipment and pump test bench

The setting and checking values given in the test specifications refer to precisely specified test equipment. The most important components of the test equipment are: calibrating nozzle-and-holder assembly and calibrating fuel-injection tubing.
Possible variants of such test equipment are listed in the following. The first-mentioned calibrating fuel-injection tubing and calibrating nozzle-and-holder assemblies represent the usual test equipment for the respective pump type. Different versions of test equipment are listed after.
The calibrating fuel-injection tubing and calibrating nozzle-and-holder assemblies which are to be used are strictly specified in the test specifications for each injection-pump assembly.
The test equipment also contains a list of the types of test bench which are approved for each size of pump. Failure to comply with these instructions will lead to serious setting errors on pumps and to incorrect test results.
Models of test bench which are not listed must not be used.

1.8 Test benches and test equipment assigned to models of injection pump

Pump model: PE(S)..A.., PE(S)..AM..

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure
Model designation (no. of measuring points) Remarks, restrictions	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perforated plate 1 Part No. 2 Bore dia.	2 Overflow valve/ Part No. 3 Remarks
EFEP 375.. (8) * EFEP 385.. (12) * EFEP 390.. (12) * EFEP 410.. (12) * ESP 270.. (8) EFEP 500.. (8) EFEP 515.. (12) EFEP 615.. (12) * with large flywheel 1 686 609 057 all injection-pump versions;	1 1 680 750 014 2 6 x 2 x 600 mm 3 M 12 x 1.5 4 possible deviations (given on test-specification sheet): 1 1 680 750 015 2 6 x 1.5 x 600 mm 3 M 14 x 1.5 1 1 680 750 008 2 6 x 2 x 600 mm 3 M 14 x 1.5 1 9 681 230 702 2 6 x 2 x 600 3 9/16" - 18 1 9 681 230 706 2 6 x 2 x 600 mm 3 9/16" - 18 (Ermeto)	1 0 681 343 009 EF 8511/9A 2 172 + 3 bar (175 + 3kp/cm²)	1 0 681 443014 EFEP 182 2 S pintle nozzles	-----	1 1.0 bar (kp/cm²) 1 417 413 000 or 2 as given in test-specification sheet for pump 3 Scavenging: with PE(S)..A..D.. and PE(S)..AM..D.. all versions with all other PE(S)..A.. and PE(S)..AM.. as of 8 mm plunger-and-barrel assembly diameter

Test benches and test equipment assigned to models of injection pump (continued)

Pump model: PE(S)..P.. (up to 11 mm plunger diameter)

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure 2 Overflow valve/ Part No. 3 Remarks
Model designation (no. of measuring points remarks, restrictions)	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perfor. plate 1 Part No. 2 Bore dia.	
EFEP 410.. (12) 1) EFEP 375.. (8) * EFEP 385.. (12) * EFEP 390.. (12) * EPS 270.. (8) 2) EFEP 500.. (8) 2) EFEP 515.. (12) EFEP 615.. (12) *with large flywheel 1 686 609 057 all injection pump versions: 1) up to PE(S) 8P 110.. with large flywheel 2) up to PE(S) 6P 110..	1 1 680 750 015 2 6 x 1.5 x 600 mm 3 M 14 x 1.5 4 Possible deviations (given on test-specification sheet). 1 9 681 230 724 2 6 x 1.5 x 750 mm 3 M 14 x 1.5	1 0 681 343009 EFEP 8511/ 9A 2 172 + 3 bar (175+3kp/cm²) 1 1 688 901016 2 207 + 3 bar (211+3kp/cm²)	1 0 681 443014 EFEP 182 2 S pintle nozzle 1 0 688 901999	----- 1 1 680 103095 2 0.5 mm dia	1 1.5 bar (kp/cm²) 2 1 417 413 025 or as given in test-specification sheet for pump 3 Scavenging

Test benches and test equipment assigned to models of injection pump (continued)

Pump model: PE(S)..MW..

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure 2 Overflow valve/ Part No. 3 Remarks
Model designation (no. of measuring points remarks, restrictions)	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perfor. plate 1 Part No. 2 Bore dia.	
EFEP 5.. (8) 1) EFEP 25.. (8) 1) EFEP 375.. (8) * EFEP 385.. (12) * EFEP 390.. (12) * EFEP 410.. (12) * EPS 270.. (8) EFEP 500.. (8) EFEP 515.. (12) EFEP 615.. (12) * with large flywheel 1 686 609 057 all injection pump versions 1) up to PE(S) 5 MW 55..	1 1 680 750 014 2 6 x 2 x 600 mm 3 M 12 x 1.5 4 possible deviations (given on test-specification sheet): 1 1 680 750 014 2 6 x 2 x 600 mm 3 M 12 x 1.5 1 1 680 750 008 2 6 x 2 x 600 mm 3 M 14 x 1.5 1 1 680 750 008 2 6 x 2 x 600 mm 3 M 14 x 1.5	1 0 681 343 009 EF 8511/9A 2 172 + 3 bar (175+3kp/cm²) 1 1 680 901 016 2 207 + 3 bar (211+3kp/cm²) 1 0 681 343 009 2 172 + 3 bar (175+3kp/cm²) 1 1 688 901 016 2 207 + 3 bar (211+3kp/cm²)	1 0 681 443014 EFEP 182 2 S pintle nozzle 1 1 688 901999 1 0 681 443014 EFEP 182 2 S pintle nozzle 1 1 688 901999	----- 1 1 680 103095 2 0.5 mm dia ----- 1 1 680 103095 2 0.5 mm dia	1 1.5 bar (kp/cm²) 2 1 417 413 000 or as given in test-specification sheet for pump. 3 Scavenging For 5.5 mm plunger diameter there applies: 1 1.0 bar (kp/cm²) 2 1 417 413 012 3 Scavenging

Test benches and test equipment assigned to models of injection pump (continued)

Pump model: PE(S)..P.. (as of 12 mm plunger diameter) - except PE(S)..P..7000 series

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure 2 Overflow valve/ Part No. 3 Remarks
Model designation (no. of measuring points) Remarks restrictions	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perfor. plate 1 Part No. 2 Bore dia.	
EFEP 375.. (8) 1) * all pump versions EFEP 385.. (12) 2) * all pump versions EFEP 390.. (12) 3) * all pump versions EFEP 410.. (12) 1) * up to PE(S) 8P 130.. EPS 270.. (8) 1) up to PE(S) 6P 120.. EFEP 500.. (8) 1) up to PE(S) 6P 120.. EFEP 515.. (12) 4) all pump versions EFEP 615.. (12) 5) all pump versions *with large flywheel 1 686 609 057	1 1 680 750 060 2 8 x 2 x 1000 mm 3 M 14 x 1.5 4 possible deviations (given on test-specification sheet) 1 1 680 750 061 2 8 x 2 x 1000 mm 3 M 16 x 1.5 1 1 680 750 067 2 6 x 1.5 x 1000 mm 3 M 14 x 1.5 1 1 680 750 074 2 6 x 1.5 x 1000 mm 3 M 16 x 1.5	1 0 681 443 022 EFEP 215 C 2 172 + 3 bar (175+3kp/cm²) 1 0 681 443 022 EFEP 215 C 2 172 + 3 bar 1 1 688 901 019 2 207 + 3 bar (211+3kp/cm²) 1 1 688 901 019 2 207 + 3 bar (211+3kp/cm²)	1 0 681 443021 EFEP 216A 2 T pintle nozzle 1 0 681 443021 EFEP 216A 2 T pintle nozzle 1 1 688 901999	----- ----- 1 1 680 103098 2 0.8 mm dia	1 1.5 bar (kp/cm²) 2 1 417 413 025 or as given in test-specification sheet for pump. 3 Scavenging

Continued on A22/A23

Test benches and test equipment assigned to models of injection pump (continued)

Pump model: PE(S)..P.. (as of 12 mm plunger diameter) - except PE(S)..P..7000 series

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure
Model designation (no. of measuring points) Remarks, restrictions	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perfor. plate 1 Part No. 2 Bore dia.	2 Overflow valve/ Part No. 3 Remarks
If calibrating nozzle holders are to be used with perforated plate, the following applies: 1) up to PE(S) 6 P 120.., 2) up to PE(S) 8 P 120.., 3) up to PE(S) 12 P 120.., 4) up to PE(S) 8 P 130.., 5) all injection pump versions	1 1 680 750 015 2 6 x 1.5 x 600 mm 3 M 14 x 1.5 1 1 680 750 026 2 6 x 1.5 x 600 mm 3 M 14 x 1.5 together with connecting piece 1 683 391 118 9/16" x 18 1 1 680 750 074 2 6 x 1.5 x 1000 mm 3 M 16 x 1.5	1 688 091019 2 207 + 3 bar 1 0 681 443022 EFEP 215 C 2 172 + 3 bar 1 1 688 901019 2 207 + 3 bar (211 + 3kp/cm²)	1 1 688 901999 1 1 688 901999	1 1 680 103098 2 0.8 mm dia and 1 1 680 103096 2 0.6 mm dia 1 1 680 103098 2 0.8 mm dia	

Test benches and test equipment assigned to models of injection pump (continued)

Pump model: PE(S)..P..7000 series (as of 12 mm plunger diameter)

Approved pump test benches	Specified cal.fuel-injection tubing	cal. nozzle-and-holder assemblies			1 Inlet pressure 2 Overflow valve/ Part No. 3 Remarks
Model designation (no. of measuring points) Remarks, restrictions	1 Part No. 2 O.D. x wall thickness x length 3 Delivery-valve holder thread 4 Remarks	Model 1 Part No./ mod. desig. 2 Opening pressure	cal. nozzle 1 Part No./ mod. desig. 2 Type	perfor. plate 1 Part No. 2 Bore dia.	
EFEP 515.. (12) 1) EFEP 615.. (12) EFEP 385.. (12) 2) EFEP 390.. (12) 2) 1) up to PE(S) 8 P 130.., 2) Approval of test bench models EFEP 385.. and EFEP 390.. each with large flywheel 1 686 609 057 for pumps up to PE(S) 8P 130.. is limited to end of 1986 due to ISO standards.	1 1 680 750 067 2 6 x 1.5 x 1000 mm 3 M 14 x 1.5 4 possible deviations (given on test-specification sheet)	1 1 688 901019 2 207 + 3 bar (211+3kp/cm²)	1 1 688 901999	1 1 680 103 098 2 0.8 mm dia	1 1.5 bar (kp/cm²) 2 1 417 413 025 or as given in test-specification sheet for pump 3 Scavenging
	1 1 680 750 015 2 6 x 1.5 x 600 mm 3 M 14 x 1.5	1 1 688 901019 2 207 + 3 bar (211+3kp/cm²)	1 1 688 901999	1 1 680 103 098 2 0.8 mm dia	

2. TEST BENCH ACCESSORIES

2.1 PE(S)..A.. pump assemblies

For clamping:

Clamping support		1 688 030 044
Clamping support		1 688 030 095
Universal clamping bracket		1 688 010 010
	or	1 688 010 124
	or	1 688 010 129
Locating bracket		1 688 010 033
Intermediate plate		1 682 308 010
Clamping support		1 688 030 021
Clamping flange		1 685 720 017
Reducing ring 72 mm diameter		1 680 103 107
Reducing ring 80 mm diameter		1 680 202 004
Reducing ring 85 mm diameter		1 680 202 005
Reducing ring 76.2 mm diameter		1 680 202 017
Clamping flange		1 685 720 014

For driving:

Coupling half, 17 mm cone diameter		1 416 430 012
Coupling half, 20 mm cone diameter		1 416 430 017
Puller		KDEP 1557

For measuring:

Control-rod-travel measuring device		1 688 130 095
	or	1 688 130 130
Control-rod-travel measuring device		1 688 132 005
Control-rod-travel measuring device		0 681 440 009
Dial indicator		1 687 233 015

Test bench accessories (continued)

Governor setting device	0 681 440 006
Adjustment throttle	1 688 130 132
Pressure regulator for compressed air with pressure gauge 0...4 bar	commercially available
Pressure gauge 0...1.6 bar; quality class 1.0 Scale divisions 0.05	commercially available

For adjusting:

Socket wrench set	KDEP 1541
Socket wrench set	KDEP 1048
Pin-type socket wrench	KDEP 2968
Wrench for adjusting the sleeve position	KDEP 1542

2.2 PE(S)..MW.. pump assemblies

For clamping:

Clamping support	1 688 030 111
with intermediate plate	1 682 310 026
Clamping support	1 688 030 122
Universal clamping bracket	1 688 010 010
or	1 688 010 124
or	1 688 010 129
Clamping flange	1 685 720 017
Clamping flange	1 685 720 060
Reducing ring	1 680 202 005

For driving:

Coupling half, 17 mm cone diameter	1 416 430 012
Coupling half, 20 mm cone diameter	1 416 430 017
Coupling half, 25 mm cone diameter	1 416 430 007

For measuring:

Control-rod-travel measuring device	1 680 130 030
with tube fitting	1 683 350 065
with driver pin	1 683 201 013
or	
Control-rod-travel measuring device	1 680 130 130
with tube fitting	1 683 350 064
with driver pin	1 683 201 013
Control-rod-travel measuring device	1 688 130 095
Dial indicator	1 687 233 015
Governor setting device	0 681 440 006
Adjustment throttle	1 688 130 132
Pressure regulator for compressed air with pressure gauge 0...4 bar	commercially available

Test bench accessories (continued)

Pressure gauge 0...1.6 bar; quality class 1.0 Scale divisions 0.05	commercially available

For adjusting:

Socket wrench set	KDEP 1541
Socket wrench set	KDEP 1048
Wrench for adjusting the sleeve position	KDEP 1542
Pin-type socket wrench	KDEP 2968

2.3 PE(S)..P.. pump assemblies

For clamping:

Clamping support	1 688 120 032
Clamping support	1 688 030 095
Support block	1 688 030 033
Clamping support	1 688 030 047
Universal clamping bracket	1 688 010 010
Clamping bracket	1 688 010 040
Clamping bracket	1 688 010 042
Clamping bracket	1 688 010 044
Clamping flange	1 685 720 060
Clamping flange	1 685 720 159

For driving:

Coupling half	1 688 432 007
Coupling half, 25 mm cone diameter	1 416 430 022
Coupling half, 30 mm cone diameter	1 686 430 012
Coupling half, 35 mm cone diameter	1 686 430 017
Puller	KDEP 1557

For measuring:

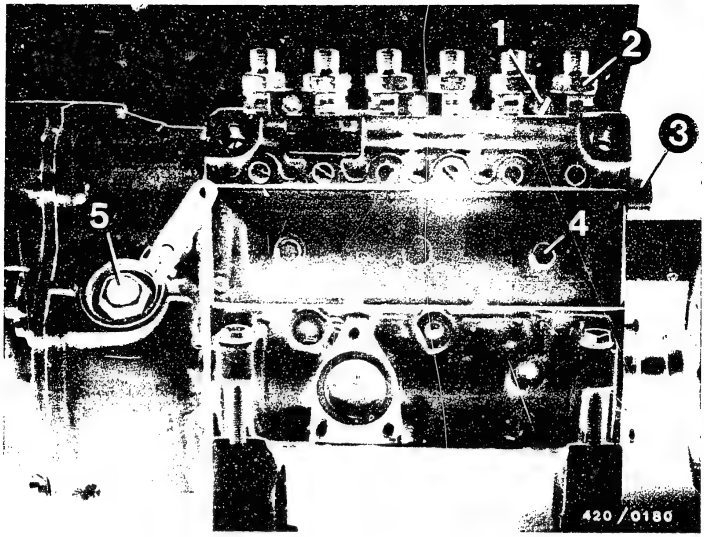
Control-rod-travel measuring device	1 688 130 130
with	1 687 000 053
Accessories	1 687 000 061
Control-rod-travel measuring device	1 680 130 030
Bushing, short	1 680 362 019
Bushing, long	1 683 350 016
Control-rod-travel measuring device	1 688 130 038
Control-rod-travel measuring device	1 688 130 079
Control-rod-travel measuring device	1 688 130 095

Test bench accessories (continued)

Dial indicator	1 687 233 015
Governor setting device	0 681 440 006
Clamping device	1 688 040 122
Adjustment throttle	1 688 130 132
Pressure regulator for compressed air with pressure gauge 0...4 bar	commercially available
Pressure gauge 0...1.6 bar, quality class 1.0 scale divisions 0.05	commercially available

For adjusting:

Socket wrench set	KDEP 1541
Socket wrench set	KDEP 1048
Wrench for adjusting the sleeve addition	KDEP 1542
Pin-type socket wrench for RSV..	KDEP 2968
Pin-type socket wrench for RSUV..	KDEP 2966



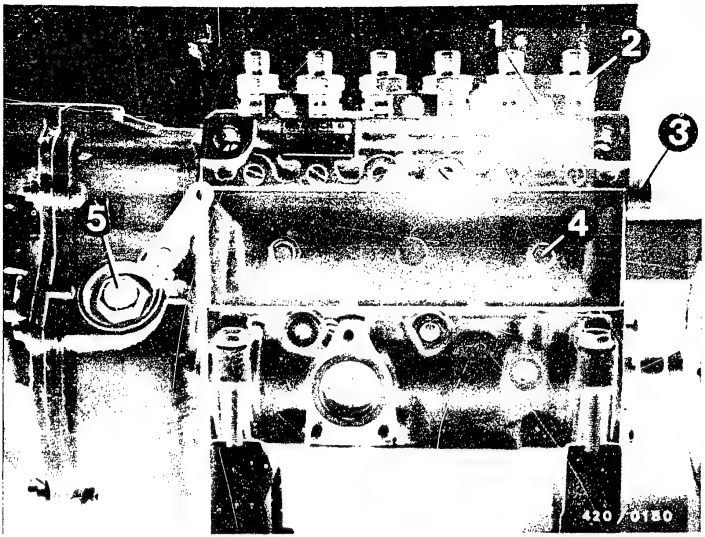
3. TIGHTENING TORQUES

3.1 Tightening torques PE(S)..A..

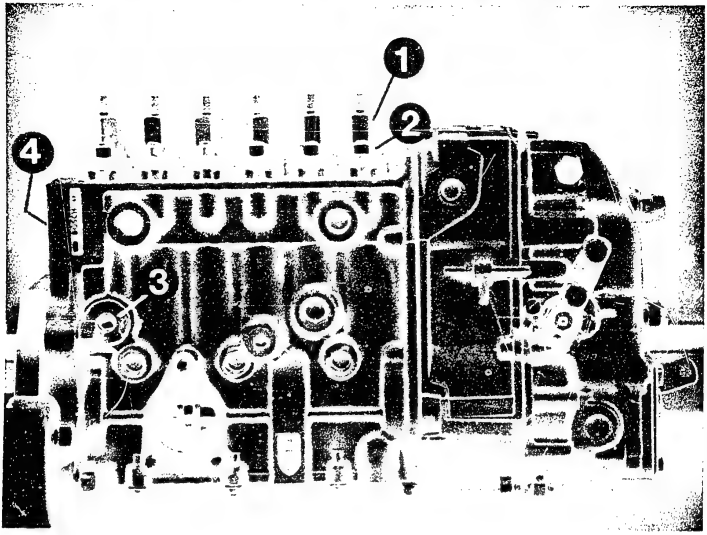
1 = Fillister-head screw 5 ... 6.5 Nm
2 = Delivery-valve holder

Model	Delivery-valve holder without ID groove	Double seal Delivery-valve holder with ID groove
PE(S)..A..C..	45-0-45-0 45...50 Nm	-
PE(S)..A..D..	-	40-0-40-0-40...45Nm* 30-0-30-0-33...37Nm**

* for PE(S) 2...6A..D..
** for PE(S) 8...12A..D..

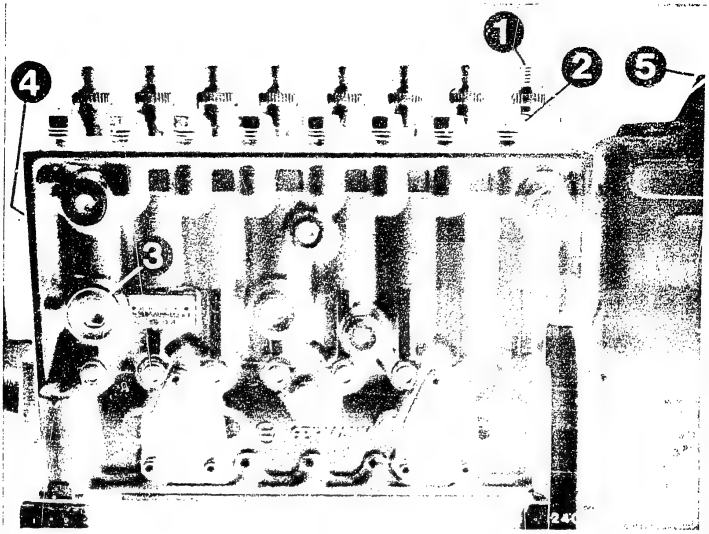


3	=	Control-rod-closure cap	10 ... 11 Nm
4	=	Spring-chamber cover fastening screws	4 ... 5 Nm



3.2 Tightening torques PE(S)..MW..

1 = Delivery-valve holder	50 ... 60 Nm
2 = Hexagon nut M8	20 ... 25 Nm
3 = Screw plug	30 ... 40 Nm
4 = Screw plug	30 ... 40 Nm



3.3 Tightening torques PE(S)..P..

1 = Delivery-valve holder

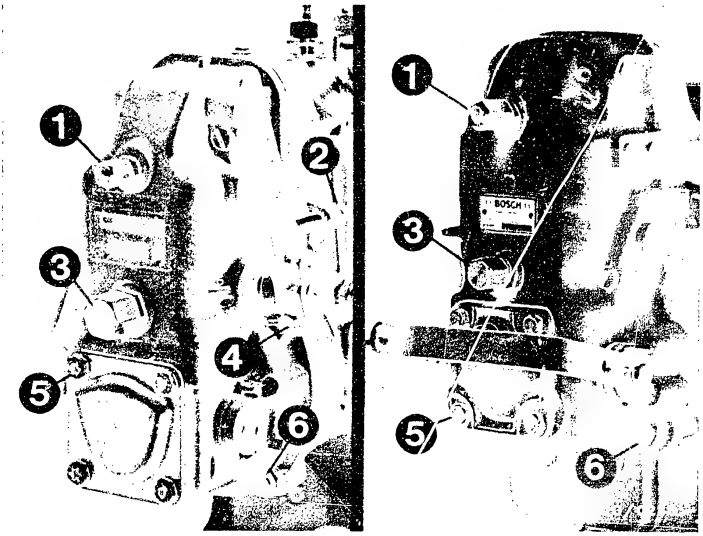
Model	Thread	Nm
PE(S)..P../..	M26 x 1.5	65 ... 80 Nm
PE(S)..P..A..	M26 x 1.5	80 ... 90 Nm
PE(S)..P..A..	M22 x 1.5	110 ...120 Nm

2 = Hexagon nut — 40 ... 45 Nm

3 = Closure cap — 40 ... 60 Nm

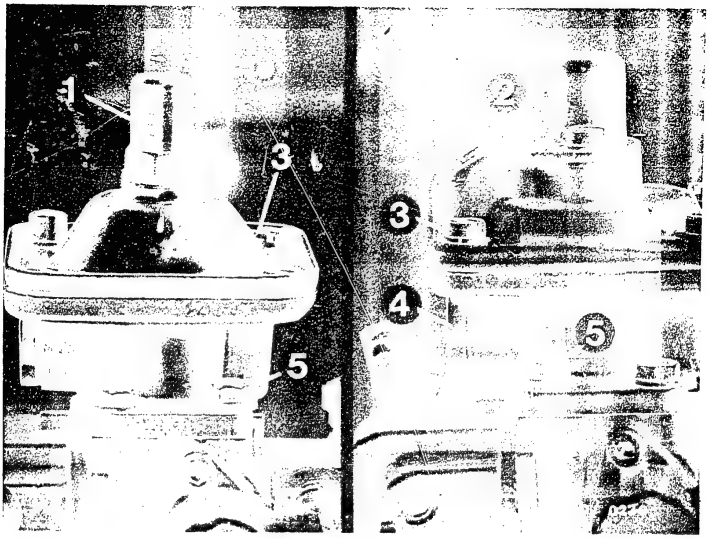
4 = Screw Plug — 40 ... 60 Nm

5 = Screw plug — 30 ... 40 Nm



3.4 Tightening torques RSV.., RSUV..

1 = Cap nut	6 ... 9 Nm
2 = Hexagon nut	6 ... 9 Nm
3 = Cap nut	10 ...15 Nm
4 = Clamping screw	8 ... 9 Nm
5 = Cover fastening screw	5 ... 7 Nm
6 = Governor cover fastening screw	5 ... 7 Nm

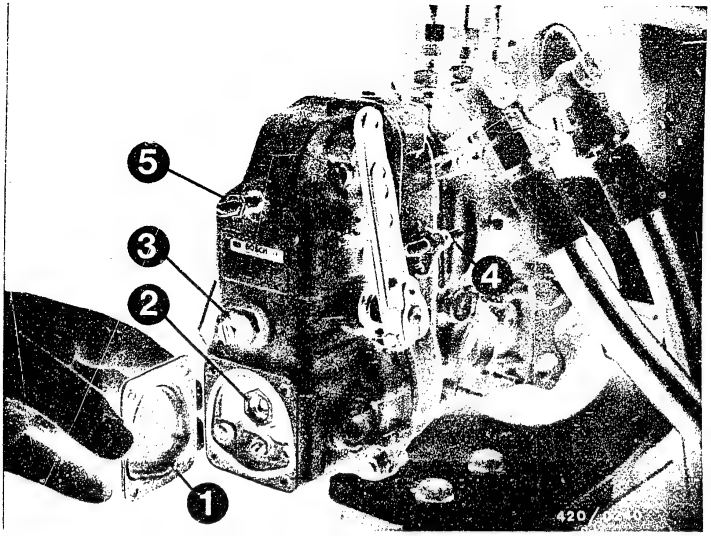


3.5 Tightening torques-Manifold-pressure compensator mounted vertically

1 =	Cap nut	25 ... 35 Nm
2 =	Fillister-head screw	5 ... 7 Nm
3 =	Fillister-head screw Break-off screw (head of screw broken off after final test)	5 ... 7 Nm
4 =	Screw plug	30 ... 35 Nm
5 =	Hexagon screw Break-off screw (head of screw broken off after final test)	5 ... 7 Nm

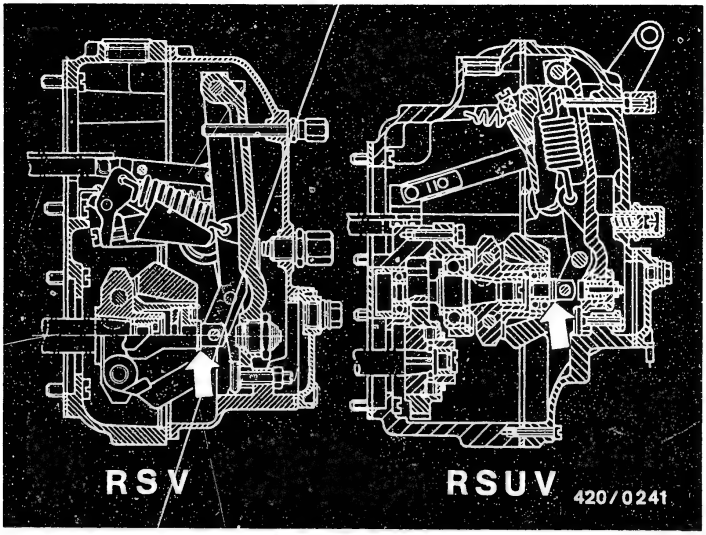
ADJUSTMENT OF GOVERNORS

Note:
The encircled numbers in the respective adjusting or test step, e.g. 1 , refer to where the corresponding test specifications and setting values are listed on the previously used test-specification sheets.



4. Checking and adjusting the sleeve position 1

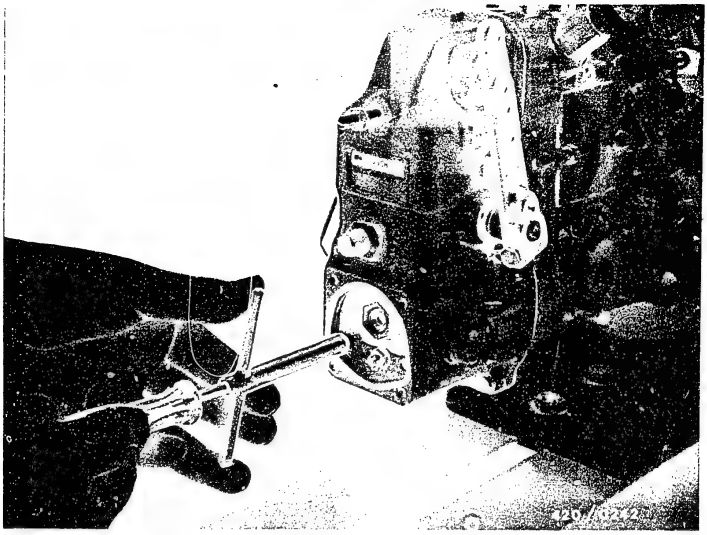
Manifold-pressure compensator (if applicable) removed. Mount control-rod travel measuring device and set to "0" with control rod in shutoff position. Take off closure cover (1). Screw back torque-control spring retainer (2), idle auxiliary spring (3), maximum-speed stop screw (4) and idle/shutoff stop screw (5). With the control lever loose and at the stated speed, the specified control-rod travel must be obtained. If the values are not obtained, adjust the sleeve position.



Governors with sleeve for adjustment with shims

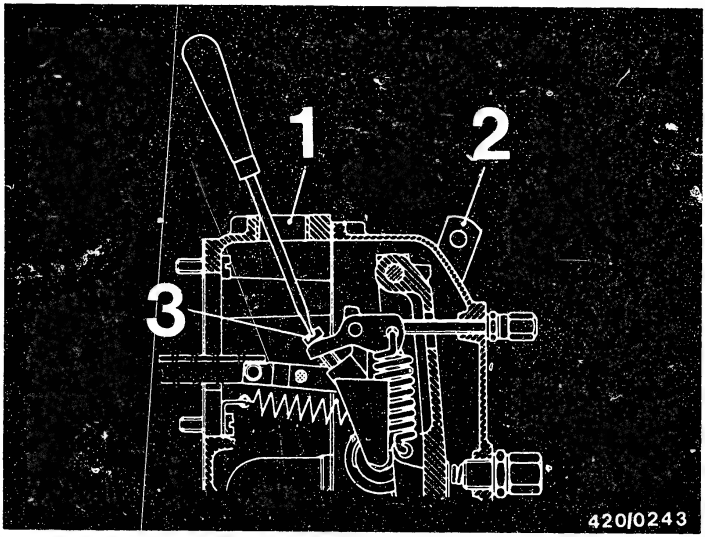
Switch off test bench.
Remove governor cover. Remove sleeve from sliding bolt and adjust sleeve position with shims (arrow). Thicker shims result in a shorter control-rod travel.

Re-mount governor cover. Observe tightening torque for fastening screws.



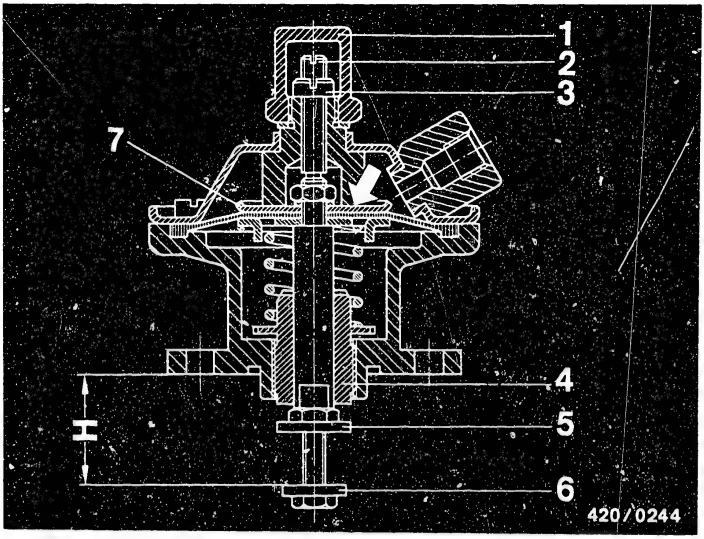
Governors with externally adjustable sleeve

Continue to run the injection-pump assembly at the specified speed and, by turning the adjusting screw with socket wrench KDEP 1542, adjust the sleeve position until the control-rod travel measuring device indicates the specified value.
Lock the adjusting screw.



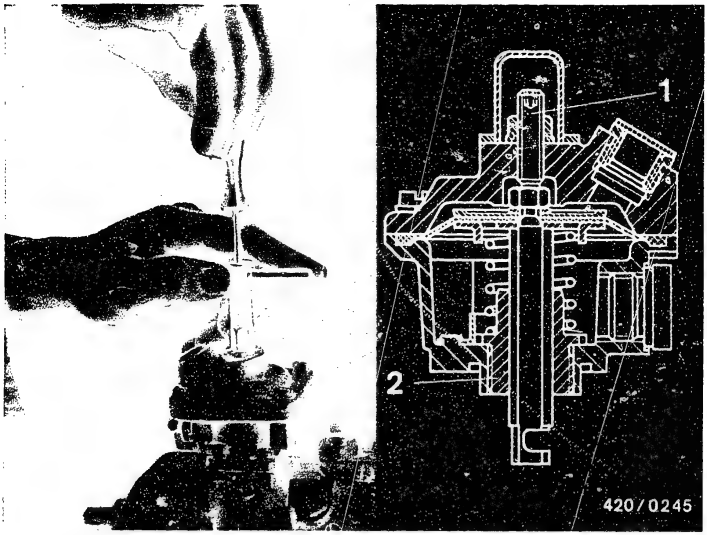
5. Adjusting the governor spring preload 1

Unscrew upper screw plug on governor housing.
With the pump stopped, swivel governor control lever (2) as far as possible toward "idle".
Through the open bore (1), first of all screw in the adjusting screw (3) as far as it will go. Then unscrew this screw by as many turns as are given for "x" on the test-specification sheet.
The adjusting screw has a ratchet which allows 4 notches for each turn of the screw.
x = 3.5 therefore means 3.5 x 4 = 14 notches.
If "x" is not given on the test-specification sheet, assume "x = 3.5".



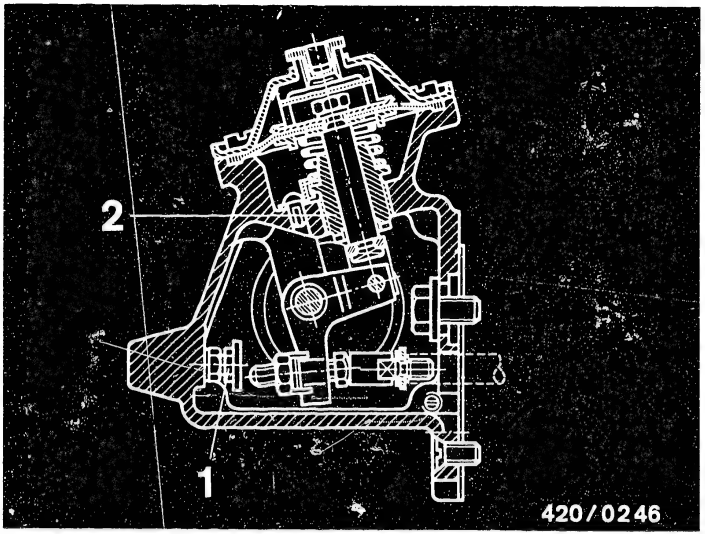
6. Presetting the manifold-pressure compensator with stop screw (vertically mounted)

After unscrewing the cap nut (1) and loosening the slotted round nut (3), unscrew the stop screw (2) using socket wrench set KDEP 1542 until the diaphragm plate (7) is up against the manifold-pressure compensator cover (arrow).
Then screw in stop screw (2) again by 0.5 mm and lock. In this position, set dimension "H" at screw (6) with lock nut (5).
Dimension "H" is given in the test-specification sheet either under "Remarks" or, in earlier test-specification sheets, at another suitable place.
Fully relax the manifold-pressure compensator spring by screwing back the adjusting screw (4).



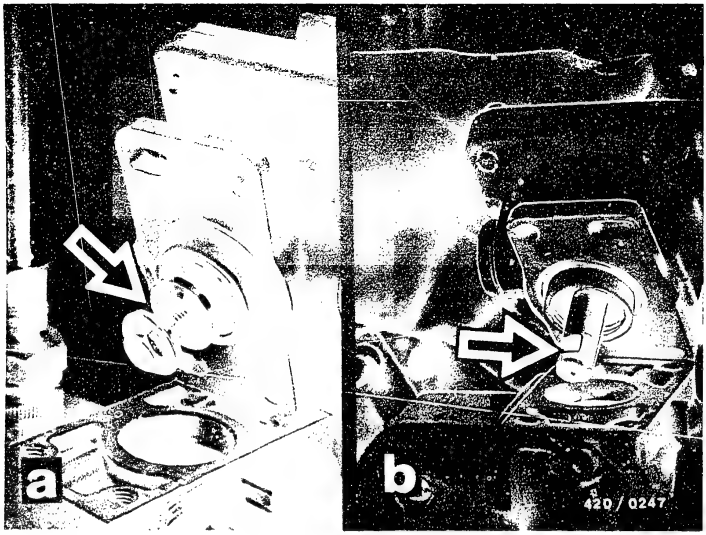
Presetting the standard manifold-pressure compensator (vertically mounted)

Using socket wrench set KDEP 1048, unscrew the naturally-aspirated delivery adjusting screw (1) until the diaphragm plate is up against the manifold-pressure compensator cover on the inside. Then screw in adjusting screw again by 0.5 mm and lock. Fully relax manifold-pressure compensator spring by screwing back the adjusting screw (2).



Presetting the manifold-pressure compensator mounted at the drive end

Screw back delivery adjusting screw (1) so that the manifold-pressure compensator cannot influence the control rod. Fully relax the manifold-pressure compensator spring by screwing back the adjusting screw (2).

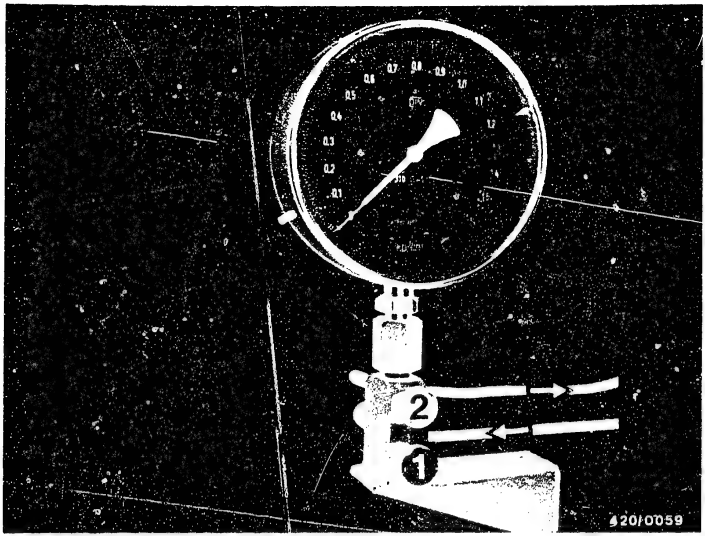


7. Mounting the manifold-pressure compensator according to installation position

Mounting the vertical manifold-pressure compensator

Tilt up the bell crank in the governor. Make sure that it comes to lie between the shims of the stop screw (picture a-arrow) or in the machined slit (picture b-arrow), depending on the version of manifold-pressure compensator rod. Do not forget O-ring when mounting the manifold-pressure compensator.

Connect compressed-air supply to manifold-pressure compensator as specified.

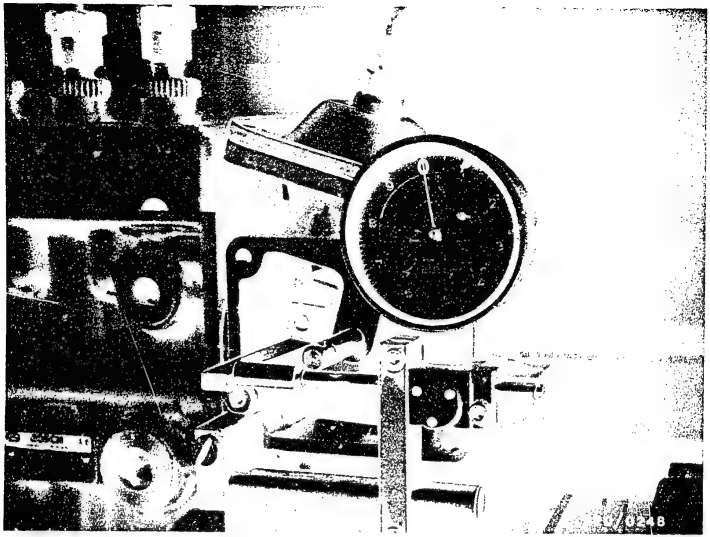


Adjusting screw 1 (bottom) for adjusting the pressure.

Screw plug 2 (top) for leak test on diaphragm chamber.

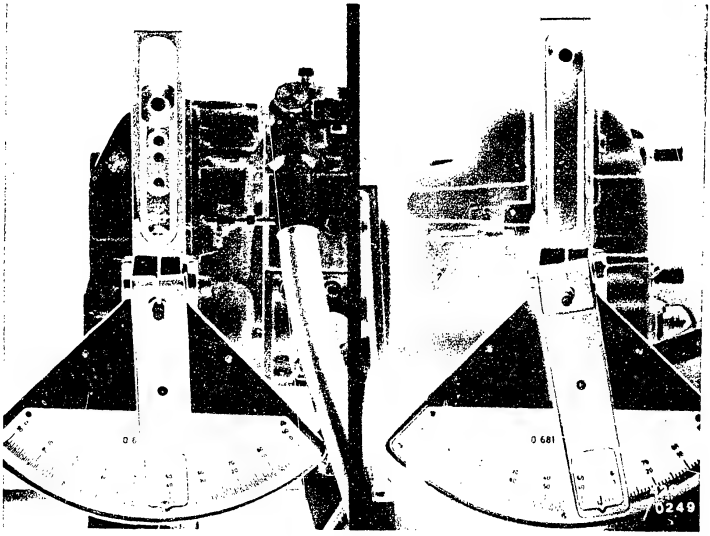
Connection of manifold-pressure compensator to compressed air

Establish connection between pressure regulator and bottom connection of adjustment throttle. Connect manifold-pressure compensator to upper connection of adjustment throttle.



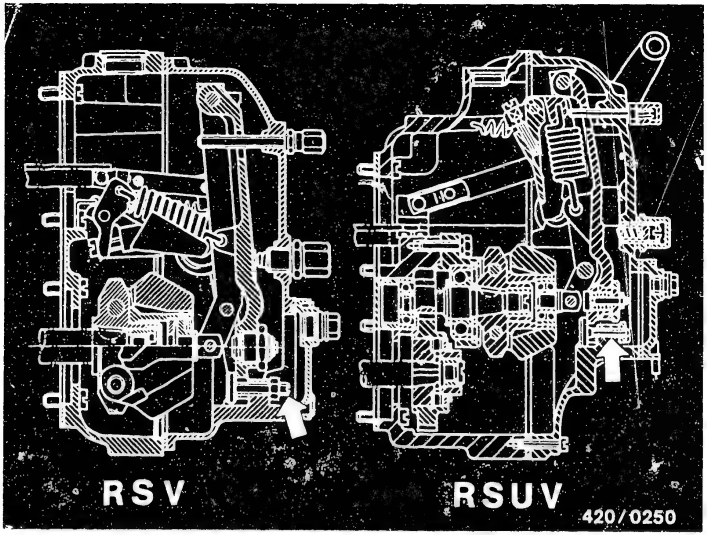
If mounting the drive-end manifold-pressure compensator, use control-rod travel measuring device 1 687 130 130 with accessories set 1 687 000 061, and set the dial indicator to "0" with the control rod in the shutoff position.

Connect compressed-air supply to the manifold-pressure compensator as specified.



8. Mounting the setting device 0 681 440 006

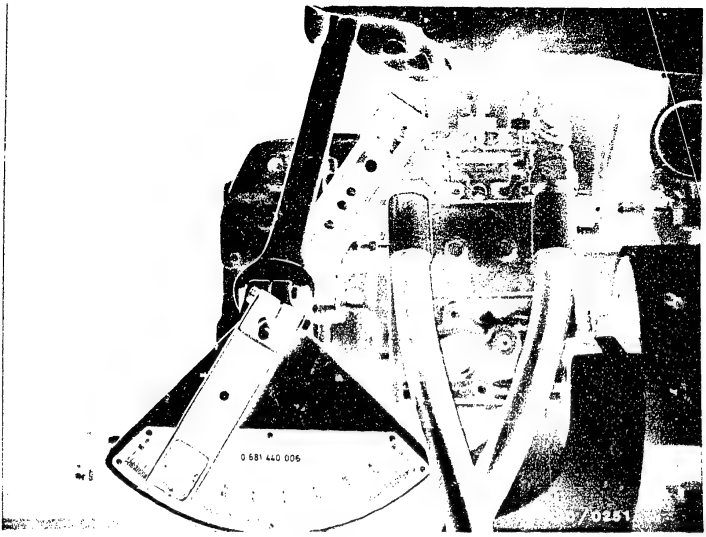
Adjustment is performed with the control lever in the vertical position.
Set scale of device to 40° for RSV governor and to 35° for RSUV governor.



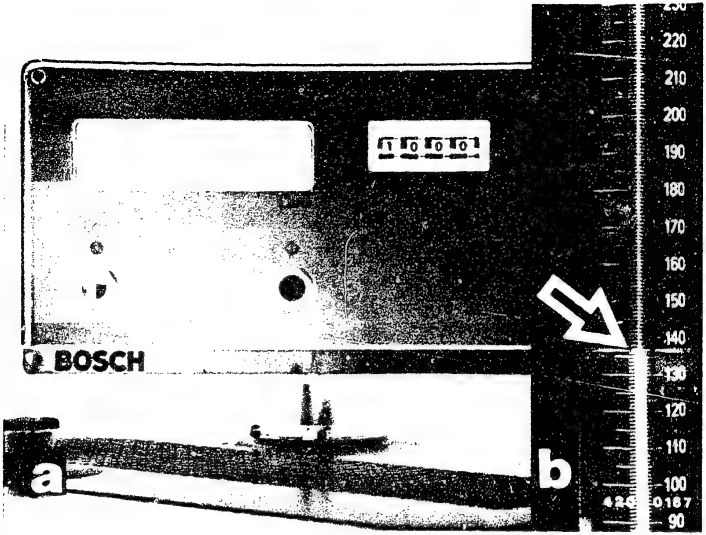
9. Setting the full-load delivery 2b

The full-load delivery on RSV and RSUV governors is set - even if there is a manifold-pressure compensator - only at the full-load delivery adjusting screw (arrow) on the governor. A special setting is required for governors without full-load delivery adjusting screw. The procedure is described after the normal procedure for setting the full-load delivery.

Set the specified charge-air pressure if there is a manifold-pressure compensator. This charge-air pressure remains set until the checking of the torque-control characteristic has been completed.



Drive injection-pump assembly at specified speed. Swivel control lever to max. possible deflection and lock in this position with locking nut of setting device. Set stroke counter to "100" and switch on. During the first measurement which now follows, the quantity of calibrating oil which is collected in the measuring glasses of the test bench is used not for measuring the fuel delivery, but for wetting the measuring glasses. The measuring glasses are emptied again. The discharge time is 29 to 31 seconds. If the pause after emptying is longer than 10 minutes, wet the measuring glasses again.



Set the stroke counter to "1000" and trigger. After the stroke counter has completed the measurement, the quantity of calibrating oil in each measuring glass is read off and noted down.
The quantity of calibrating oil in the measuring glass is precisely indicated by a blue stripe which is opposite the numbering on the measuring glass.
If the measuring glass is wetted, light refraction at the surface of the liquid results in two superimposed points. Always read off the fuel delivery at the scale mark indicated by the two points.

The fuel delivery given in the test specifications is the average of all individual deliveries measured. At the same time, establish whether the allowable dispersion given in the test specifications is exceeded. The dispersion identifies the difference between the largest and the smallest deliveries.

Examples:
Specified delivery = 121...123 cm^3/1000 strokes
Allowable dispersion = 3 cm^3/1000 strokes

Measurement 1:

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	125	123	125	124	123.8

Dispersion: 125-122 = 3 cm^3/1000 strokes

This setting is not allowable. The average of all cylinders is not between 121 and 123 cm^3/1000 strokes.

Measurement 2:

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	120	123	121	124	122.3

Dispersion: 124-120 = 4 cm^3/1000 strokes

This setting is likewise not allowable. The dispersion is greater than 3 cm^3/1000 strokes.

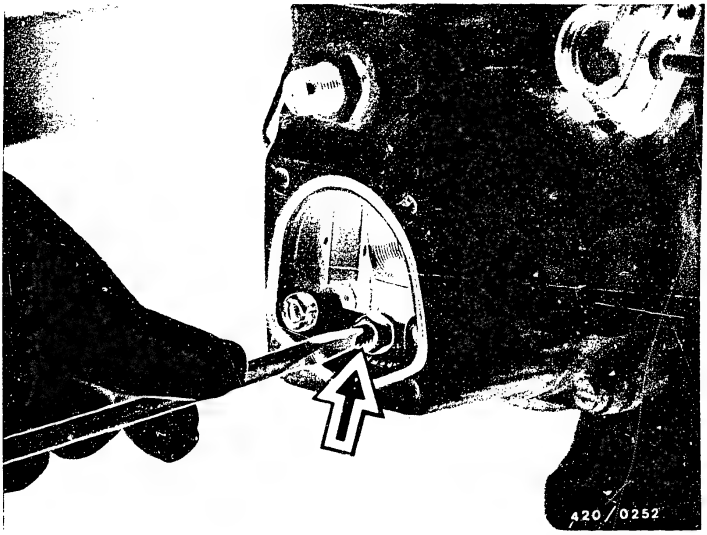
Measurement 3:

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	122	123	121	124	122.6

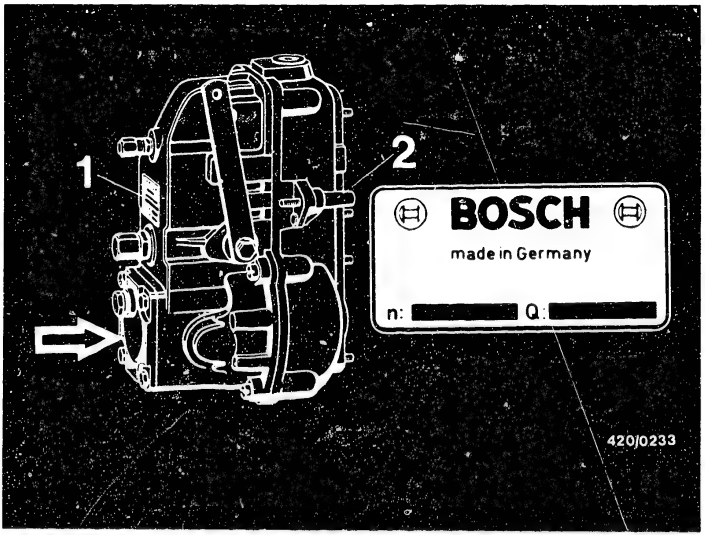
Dispersion: 124-121 = 3 cm^3/1000 strokes

This setting is allowable.

Values in parentheses apply only when checking a pump, not when resetting.



If the measured full-load delivery does not agree with the test specification, loosen the full-load delivery adjusting screw lock nut.
Set the specified delivery by turning the full-load delivery adjusting screw (arrow).
Screwing in the screw results in an increased delivery.



1 = Nameplate with changed data
2 = Max.-speed (full-load speed) stop
Arrow = Change of full-load delivery and sealed cover

Special cases:

Stamping of full-load deliveries and speeds

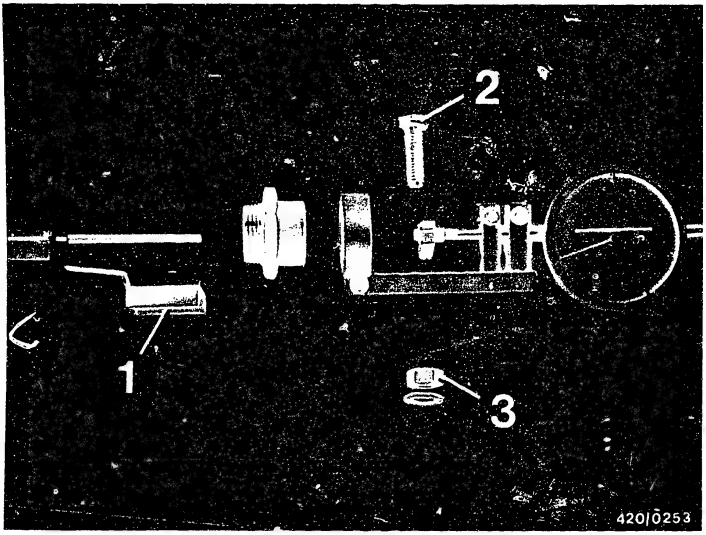
When setting EP/RSV governors, note in addition to the changed speeds also the changed full-load deliveries.

Therefore, whenever setting operations are being performed, always check the nameplates of pump and governor for additional information.

Special nameplate for MWM

n = Speed(s) to be set
Q = Specified full-load delivery/deliveries
c = Spring constant of torque-control spring
V = Preload of torque-control spring

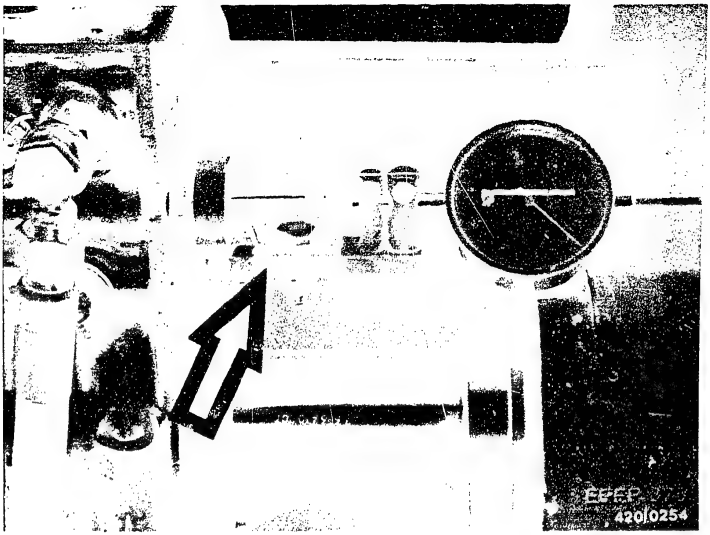
(Earlier nameplates had only one speed and one full-load delivery).
This special setting of the full-load delivery in accordance with the data on the additional nameplate corresponds to the specified power output of the engine.



Governors without full-load stop screw with stop on drive end

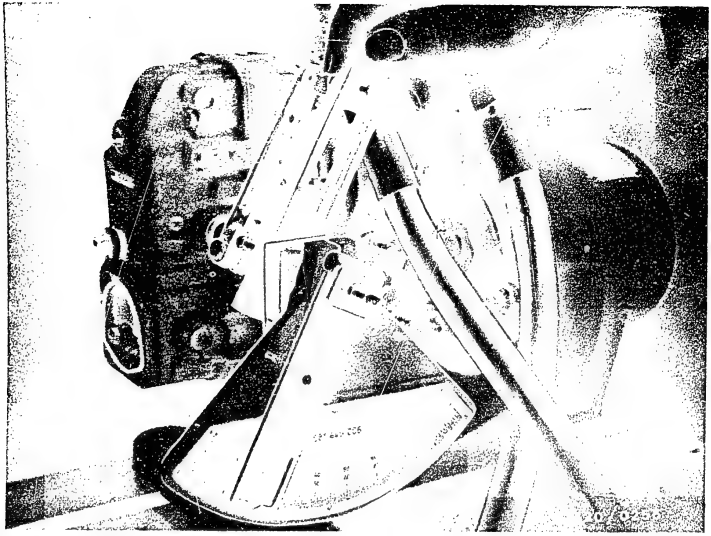
Preparations

With this device, the feeler locks the control rod at the desired full-load control-rod travel. The feeler (1) is movably mounted on the existing control-rod travel measuring device 1 688 130 030 and is locked with screw (2) and nut (3). The device in the picture is the welded version with 8.5 mm diameter bore which has been supplied since 1968. The additional equipment shown in the picture cannot be used in conjunction with the earlier cast-iron version.



Mount control-rod travel measuring device 1 688 130 030 with feeler (arrow) on the injection pump.
Set dial indicator to "0" with the control rod in the shutoff position.

Drive the injection-pump assembly at the specified speed and measure the full-load delivery. If the measured delivery does not agree with the test specification, move the feeler until the control rod has obtained the required full-load position.
Tighten hexagon screw for locking the feeler after each adjustment.

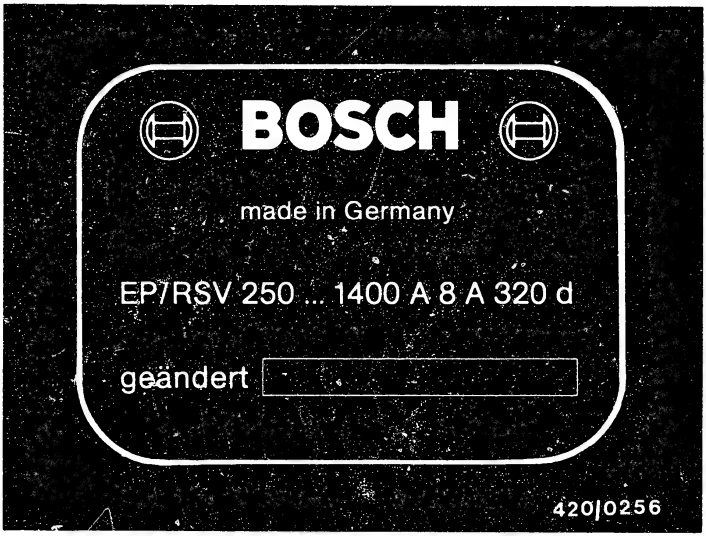


10. Setting the maximum full-load speed 2a

Set the control lever to the angle position given in the test specifications. Starting from 0 min^{-1}, raise the speed until the stated control-rod travel is indicated by the control-rod travel measuring device. Read off speed. It must be within the corresponding speed range given in the test specifications. If the speed is not obtained, change the position of the control lever within the stated range.
If necessary, an adjustment can also be made by changing the governor spring preload at the notched screw of the rocker inside the governor. Turning the screw in a clockwise direction results in increased governor spring preload and thus in increased control-rod travel.

Checking:
The speed tolerance for checking is not separately listed. It is ± 5 min^{-1} in addition to the speeds given there.

Example: 1340...1350 (1335...1355) min^{-1}.



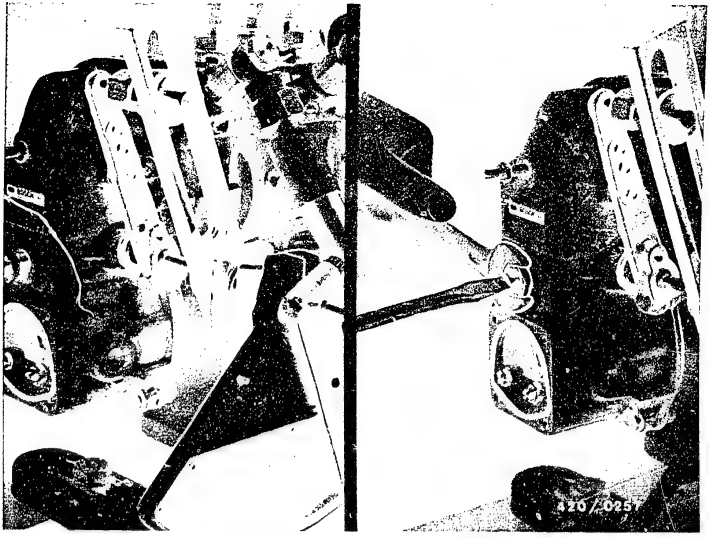
Special case:

Speed droop adjustment and speed readjustment

The full-load speed is raised or lowered by changing the adjustment of the maximum-speed stop screw.

If the speed droop is also to be reduced, remove the screw plug at the top in the governor housing and bring the control lever into the shutoff position. It is then possible to turn the adjustable ratchet-type slotted-head screw. Turning in a clockwise direction increases the governor spring preload and reduces the speed droop (at the same speed, but with reduced control-lever travel). Vice versa if turned counterclockwise.

Stamp new speed in the free field "geändert" (changed).



11. Setting the minimum full-load speed 4

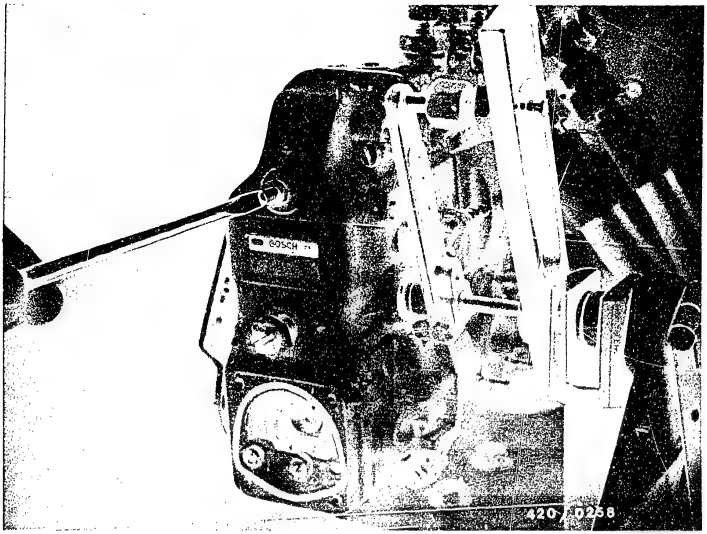
Governors without stop lever

Drive injection-pump assembly at the setting point speed and swivel control lever out of shutoff position until the specified control-rod travel is obtained. Clamp control lever in this position. The resulting control-lever position must be within the specified range. Screw in idle auxiliary spring until, at the same speed, the control-rod travel has increased by 0.5 mm. Tighten lock nut. Screw on cap nut.

Clamp the control lever in the previously established position. Set the speed as specified and take the corresponding readings at all measuring points. They must be within the stated tolerance. At control-rod travel 0...1.5 mm, delivery must have been terminated on all plunger-and-barrel assemblies.

Also check all measuring points with falling speeds. The control rod must follow briskly without stuttering. The difference in control-rod travel as compared to rising speeds may be max. 1.0 mm.

Switch off the pump and press the control lever toward "SHUTOFF". Then adjust the shutoff stop screw until a control-rod travel of 0.5...1.0 mm is obtained. Tighten lock nut. Screw on cap nut.



Governors with stop lever 4a

Drive governor at minimum full-load speed. Press control lever toward "SHUTOFF" and release. Then, with the idle stop screw, move the control lever toward "MAX" until the specified setting point is obtained. Clamp the control lever. The control-lever position must be within the specified tolerance. Tighten lock nut. Screw on cap nut.

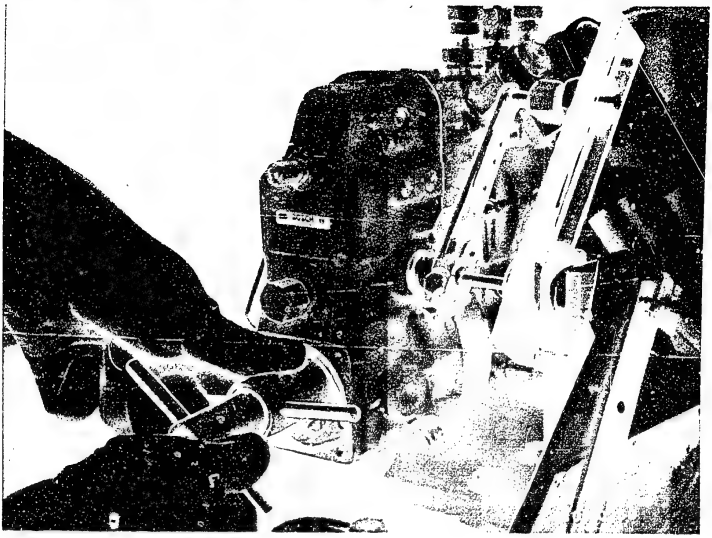
With auxiliary spring, set a 0.5 mm greater control-rod travel.
Tighten lock nut. Screw on cap nut.

Check whether, when the stop lever is actuated, the control rod moves to at least 1 mm control-rod travel before "SHUTOFF".

Clamp the control lever in the previously established position. Set the speed as specified and take the corresponding readings at all measuring points. They must be within the stated tolerance. At control-rod travel 0...1.5 mm, delivery must have been terminated on all plunger-and-barrel assemblies.

Also check all measuring points with falling speeds. The control rod must follow briskly without stuttering. The difference in control-rod travel as compared to rising speeds may be max. 1.0 mm.

If a special setting of the idle auxiliary spring is required, drive the injection-pump assembly at the specified speed. Adjust idle auxiliary spring until the specified control-rod travel is obtained.

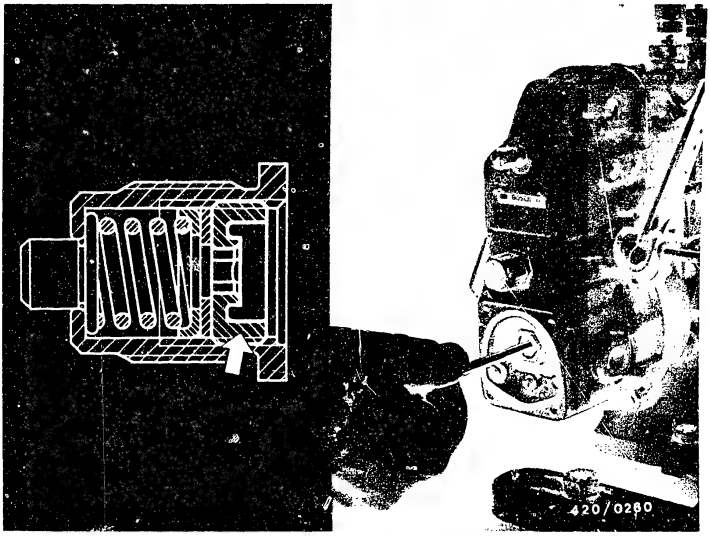


12. Checking the torque control characteristic 3

Set the governor control lever to maximum deflection and hold.
Drive the injection-pump assembly at the lowest speed given in the "TORQUE CONTROL" section. Using the appropriate setting wrench (KDEP 2968 or KDEP 1541 depending on the version of spring retainer), screw the entire torque-control spring retainer into the tensioning lever and turn until the control-rod travel specified for this speed is obtained. Tighten spring retainer lock nut.

Governors with non-adjustable torque-control spring retainer

Set further speeds listed in the "TORQUE CONTROL" section and read off the control-rod travels obtained. If the specified control-rod travel is not obtained, using socket wrench set KDEP 2968, turn the torque-control spring retainer in the tensioning lever until the specified control-rod travel is obtained.
If this is not possible, replace the spring retainer.



Governors with adjustable torque-control spring retainer

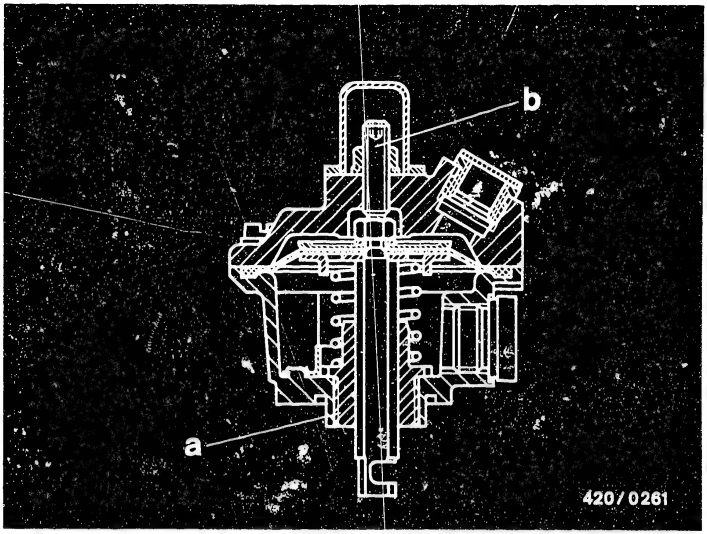
Set the middle speed of those given in the "TORQUE CONTROL" section.
Turn spring retainer adjusting screw (arrow) until the corresponding control-rod travel is obtained.

Caution:

This adjusting screw is oval in shape to lock it against turning. Therefore, it should not be screwed fully out of the spring retainer housing. If, nevertheless, this should happen, use a new adjusting screw.

13. Checking the adjustment of the manifold-pressure compensator

Drive the injection-pump assembly at the specified speed. The specified charge-air pressure for adjusting results in the stated control-rod travel insofar as the specified values have been complied with during the preceding adjusting operations.
Unscrew manifold-pressure compensator spring adjusting screw until the control-rod travel dial indicator indicates that the control rod is beginning to move.



Measuring:

At the same speed, set the pressure required for measuring. Read off the control-rod travel.
If the specified pressure is given as 0 bar, the control-rod travel is adjusted at the "naturally-aspirated delivery" adjusting screw (b).
If the pressure given is greater than 0 bar, set this pressure. Read off the resulting control-rod travel and make adjustments by changing the manifold-pressure compensator spring adjusting screw (a). As a check, set the other pressures and read off the resulting control-rod travels. If they do not agree with the test specifications, replace the manifold-pressure compensator spring with a new one.

14. Leak test on manifold-pressure compensator

Seal all openings of the manifold-pressure compensator. Set 1.0 bar charge-air pressure. Close screw plug of adjustment throttle 1 688 130 132 and shut off air supply. The pressure gauge may indicate max. 0.03 bar pressure drop within 10 sec.

15. Measuring the fuel delivery characteristic: 3a

Set the control lever to maximum deflection.
Set the specified charge-air pressure (if pump has a manifold-pressure compensator). Drive pump at specified speed and measure fuel delivery. The value given in the test specifications must be obtained when resetting. The value in parentheses applies only when checking a pump.
If more than one measuring point is given for the fuel delivery characteristic, these are checked one after the other while complying with the specified charge-air pressures and speeds.
The fuel delivery given in the test specifications is the average of all individual deliveries measured. Also establish whether the allowable dispersion given in the test specifications is exceeded. The dispersion indicates the difference between the largest and the smallest fuel deliveries.

Example
Specified delivery - 121...123 cm^3/1000 strokes
Allowable dispersion = 3 cm^3/1000 strokes

Measurement 1

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	125	123	125	124	123.8

Dispersion: 125-122 = 3 cm^3/1000 strokes

This setting is not allowable; the average of all cylinders is not between 121 and 123 cm^3/1000 strokes.

Measurement 2

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	120	123	121	124	122.3

Dispersion: 124-120 = 4 cm^3/1000 strokes

This setting is likewise not allowable; the dispersion is greater than 3 cm^3/1000 strokes.

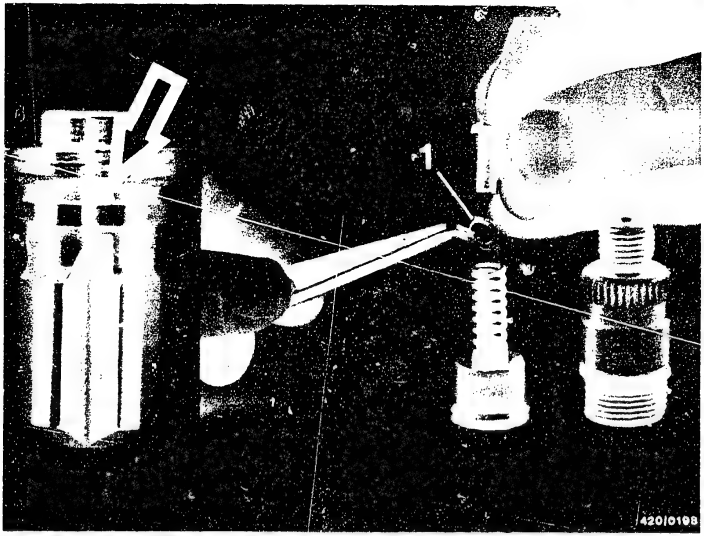
Measurement 3

Cylinder No.	1	2	3	4	5	6	Average
Delivery	124	122	122	123	121	124	122.6

Dispersion: 124-121 = 3 cm^3/1000 strokes

This setting is allowable.

If the specified fuel deliveries are not obtained at the specified speeds and charge-air pressures, it is possible to obtain the corresponding values by changing the torque control.



Adjustment in the case of torque-control delivery valves

Torque-control delivery valves can be identified by the small bore (arrow) between sealing cone and retraction collar of the valve cone.

If the specified values for the fuel delivery characteristic are not obtained, set the specified fuel delivery characteristic by selecting appropriately thick shim (1) between valve spring and filler piece.

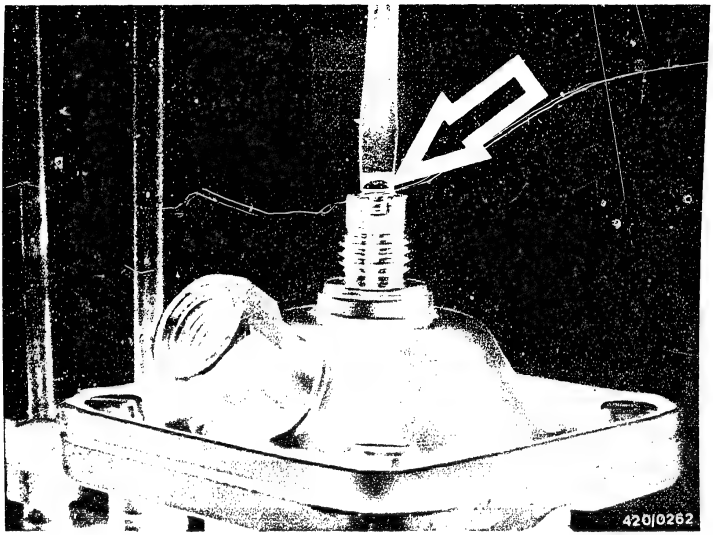
Special nameplate for MWM

n = Speed(s) to be set
Q = Specified full-load delivery/deliveries
c = Spring constant of torque-control spring
V = Preload of torque-control spring

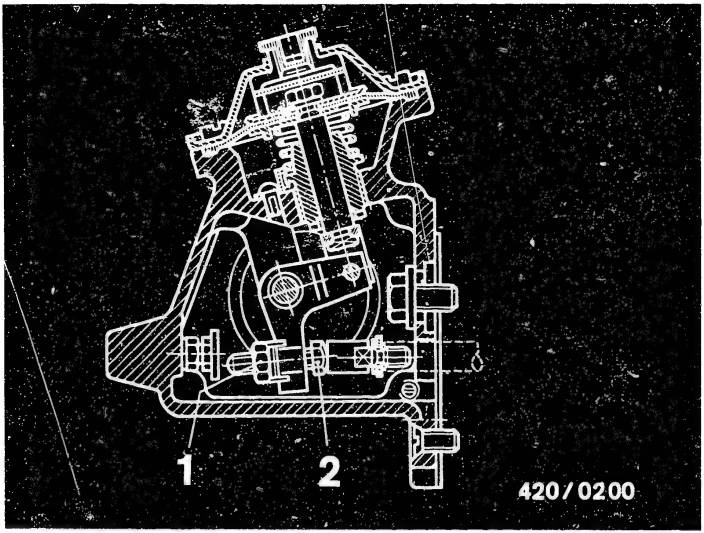
c = 6 means: Spring compressed by 1 mm results in 6 kgf increase in spring force.

Ready-set spring retainers can be obtained from MWM, quoting c and V.

If given, the second speed and the second delivery are set with the torque-control spring retainer.
If earlier test-specification sheets fail to give this second delivery, adjust the torque-control spring retainer until a change in the control-rod travel is detectable. No delivery is measured.



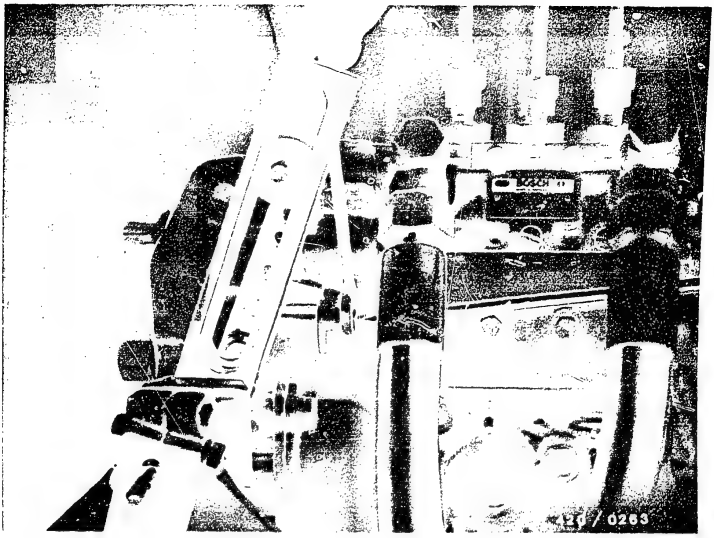
Measure the "naturally-aspirated delivery" at charge-air pressure of 0 mbar and at the specified speed. If the measured delivery does not agree with the test specification, adjust at the adjusting screw (arrow) using socket wrench set KDEP 1048.



Adjustment of fuel delivery at 0 mbar charge-air pressure (naturally-aspirated delivery) in case of manifold-pressure compensator mounted on drive end.

Remove the control-rod travel measuring device.

Loosen lock nut (1) and turn adjusting screw (2) until the specified fuel delivery is obtained. After adjustment is completed, re-tighten lock nut (1).



16. Setting the engine-speed limitation 6

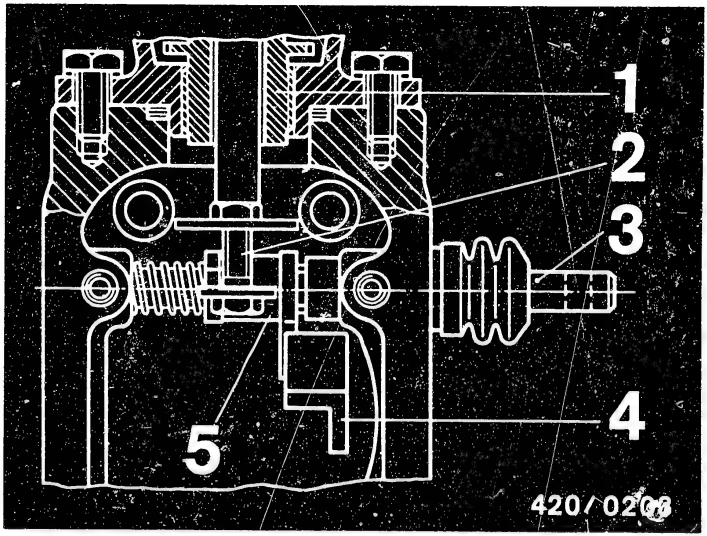
The control-rod travel given in the test specifications is 1 mm smaller than the full-load control-rod travel. Drive the injection-pump assembly at the specified speed. Move control lever in direction of maximum deflection until the specified control-rod travel is obtained. Turn maximum-speed stop screw (arrow) until it touches the control lever stop lug and lock with lock nut.

17. Adjusting the starting fuel delivery/starting control-rod travel 5

When adjusting/checking the starting fuel delivery or starting control-rod travel, take into account whether there is any special starting equipment on the governor.

In the case of governors with a vertically mounted manifold-pressure compensator, there may be a mechanical or electromagnetic or hydraulic starting fuel delivery cancelling device.

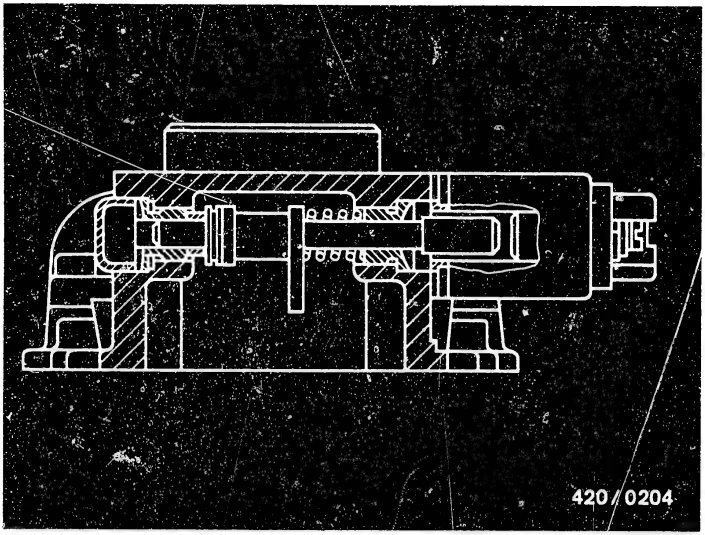
Caution:
If there is any extra equipment for controlling the starting fuel delivery, check that the equipment is correctly installed:
Through mechanical, electrical or hydraulic triggering and simultaneous swivelling of the control lever from "SHUTOFF" to "MAX", the starting fuel delivery must be obtained. When the control lever is taken back, the control rod must latch in the full-load position.



1 = Ratchet nut
2 = Stop screw
3 = Starting fuel delivery pushbutton
4 = Control rod
5 = Bell crank

Starting device with pushbutton

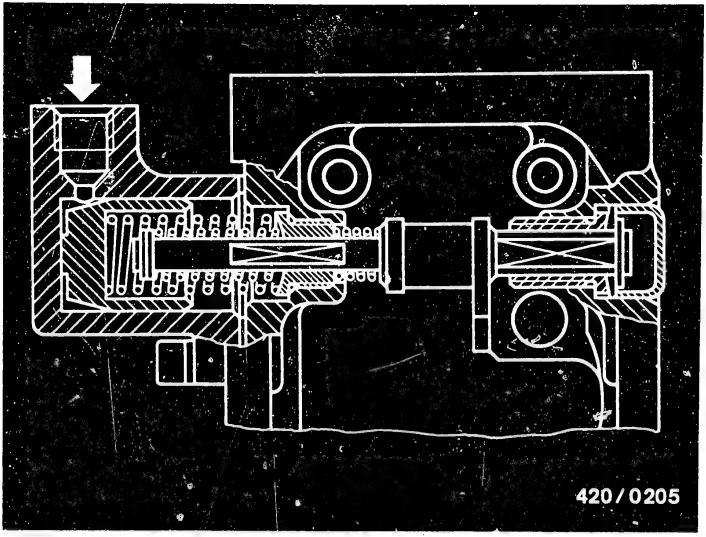
Set the speed. Control lever from "SHUTOFF" to "MAX". Press pushbutton and measure delivery.



Starting fuel delivery with electromagnetic change-over

Set the speed. Control lever from "SHUTOFF" to "MAX". Briefly switch on magnet (12 or 24 V) and measure delivery.

Caution:
Switch on magnet only briefly since it is only necessary to unlatch.

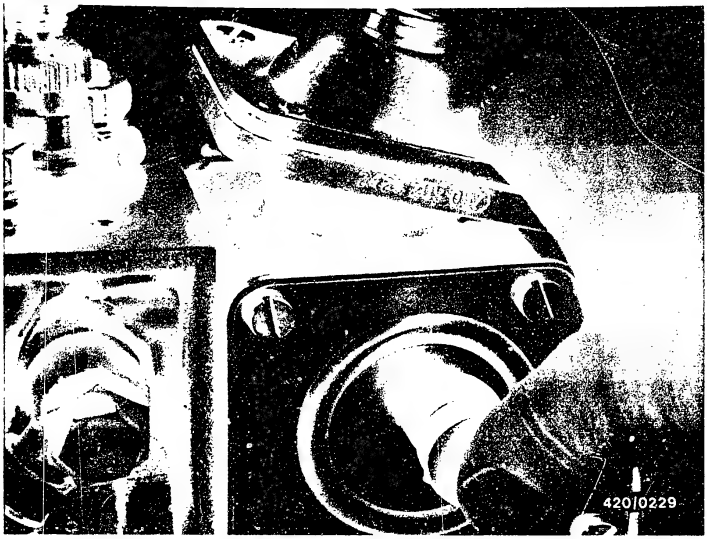


Starting fuel delivery with hydraulic change-over

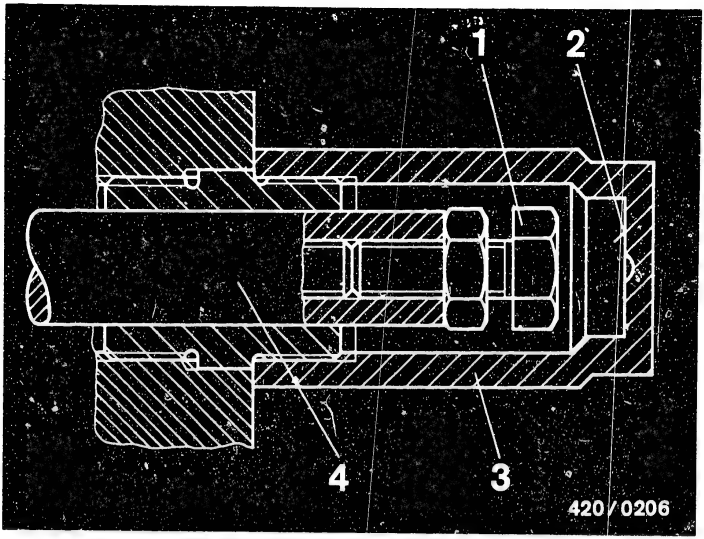
Leave stop on governor housing and connect port (arrow) to inlet line of test bench. Set the specified pressure at the test bench control valve:

At maximum pressure and n = 0 min^{-1}, control lever from "SHUTOFF" to "MAX". Full-load position must be obtained.

At minimum pressure and n = 0 min^{-1}, control lever from "SHUTOFF" to "MAX". Starting position must be obtained.

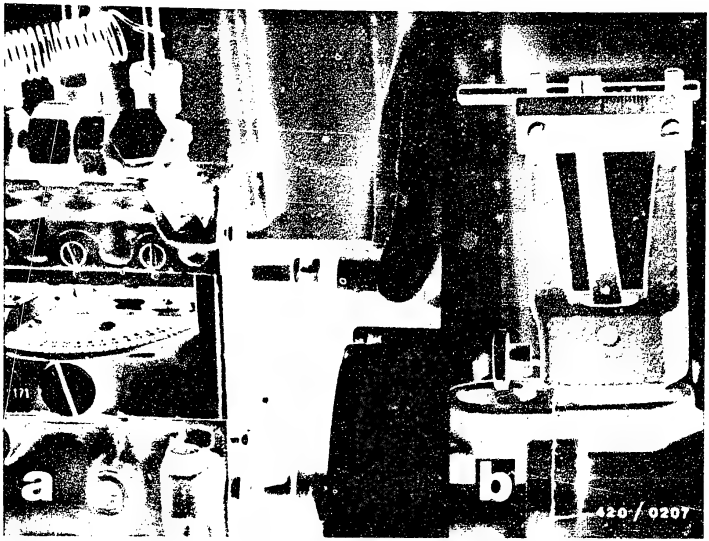


If a manifold-pressure compensator is mounted on the drive end, mount lateral closing covers of manifold-pressure compensator.
At the specified cranking speed, move the manifold-pressure compensator adjusting shaft axially until the control rod jumps into the shutoff position. Measure starting fuel delivery.

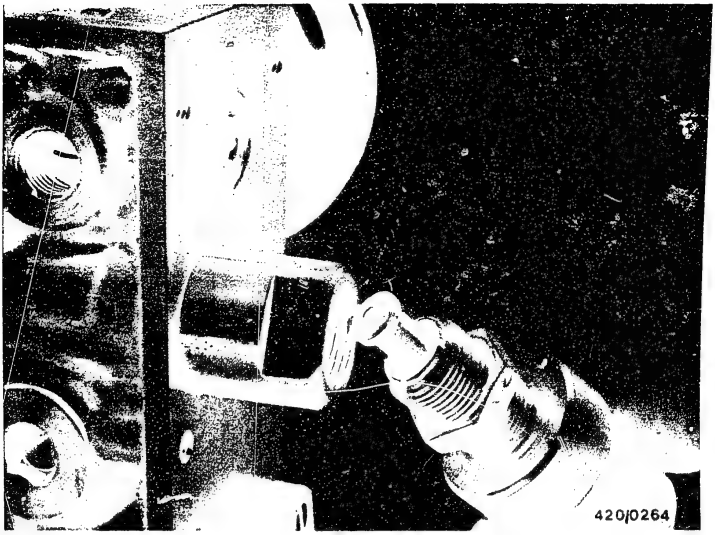


1 = Adjusting screw
2 = Stop face
3 = Closure cap
4 = Control rod

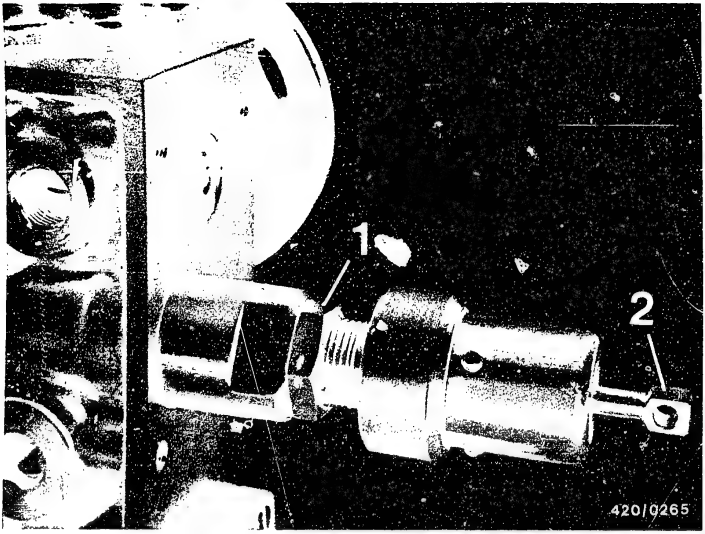
Drive injection-pump assembly at specified speed. Remove control-rod travel measuring device if a control-rod stop is mounted at the drive end for adjusting the starting fuel delivery/starting control-rod travel. The starting control-rod travel/starting fuel delivery is adjusted by appropriately screwing in the adjusting screw (1) into the control rod and screwing on the closure cap.



If only the starting control-rod travel is given in the test specifications, measuring is performed with control rod travel measuring device 0 681 440 009 (PE..A..) (picture a) or 1 688 130 079 (PE..P.., PE..MW..) (picture b).



In the case of governors without a full-load delivery adjusting screw, remove the control-rod travel measuring device with feeler. Mount full-load stop with starting fuel delivery control.



Finally set the full-load delivery at the full-load stop (1). Operate starting knob (2) and check starting fuel delivery.

If the test specifications specify the measurement/adjustment of high/low idle, the pump is driven at the specified speed and the corresponding delivery/control-rod travel is measured. Adjustment by means of the control lever is allowable within the tolerance of the engine-speed limitation. Adjusting the idle auxiliary spring is not allowed.

18. Final operations

Sealing

Tighten screws and lock nuts. Observe tightening torques.

Lock and seal stop screws with paint or wire. (If the method of locking the screws was identifiable when the pump was received, use the same method of locking).

Affix repair stamp and stamp on workshop code.

Caution:
The repair stamp and the workshop code must be renewed each time the full-load delivery and/or full-load speed are (subsequently) changed.

Remove injection-pump assembly from injection-pump test bench. Mount supply pump and, if necessary, timing device.

Leak test on camshaft chamber, spring chamber and governor chamber

Compressed air is required for the leak test. Introduce into pump camshaft chamber at a suitable point (e.g. oil inspection bore).

Immerse injection pump vertically into test bath.

Test duration and test pressure:

A and MW pump:	3 min. at 1.5 bar, then 1 min. at 0.5 bar
P pumps:	7 min. at 1.5 bar, then 1 min. at 0.5 bar

Then visually examine whether there are any leaks at joints, screw connections, seal rings and end covers on housing and cover.

To prevent possible skin rashes, grease hands beforehand with protective skin cream and wash with soap and water after testing is completed.

After-sales Service

Technical Bulletin

Injection-Pump Test Bench Conversion to Flywheel 1 686 609 057

VDT-I-400/1000 B
2. 1978

In order to mount the larger flywheel 1 686 609 057 (see also VDT-W-400/305) on the drive shaft of the injection-pump test benches EFEP 375.., 410.., 385.. and 390.., the suction line, discharge tubing and vacuum connections must be repositioned. (Items 5, 6 and 7 in Figure 1)

1. Removal of the connecting pans

1.1 Test-oil inlet - Item 6:

Remove the hose fitting on the control valve; the fitting is accessible above the oil motor after taking off the rear wall of the test-bench housing. After unscrewing the 3 countersunk-head screws, the pipe bend together with the hose can be pulled out through the hole.

1.2 Suction-line connector - Item 5:

After unscrewing the 3 countersunk-head screws, remove the pipe bend, loosen-off the hose connector and pull off the plastic hose.

1.3 Vacuum connector - Item 7:

Unscrew the countersunk-head screws, loosen-off the hose connector and pull out the hose.

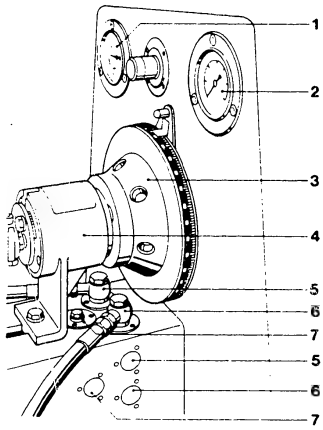


Figure 1 Front side of the upper part of the test bench

1 Thermometer
2 Pressure Gauge
3 Graduated disc
4 Backlash-free clutch
5 Suction-line connector
6 Pressure-line connector (Test-oil inlet)
7 Suction-line connector
(Blank off when not used)

BOSCH Geschäftsbereich KH. Kundendienst. Kfz Ausrüstung

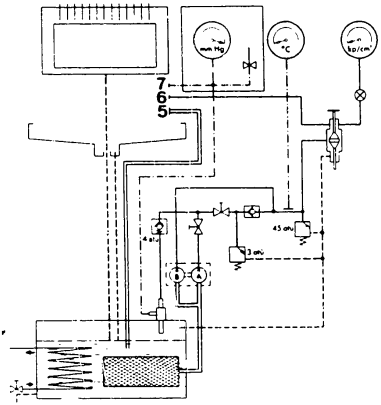


Figure 2 Line schematic

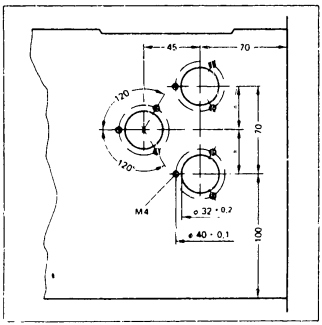


Figure 3 Drilling dimensions

2. Drilling the new conector openings

(Use flange as marking template)

The 32 mm dia. holes (cut using a spot facer), and the M 4 tapped holes, are to be located on the operating side of the test bench which experience has shown to be used the most. During drilling, beware of electric cables, it might even be abvisable to lock the push-button switch and remove the fuses.

3. Modifying the pipe bends

Modify both pipe bends, for test-oil inlet and for suction-line connector, in accordance with Figure 4 so that they fit during reassembly. Shorten them as shown in Figure 4 and re-solder (braze).

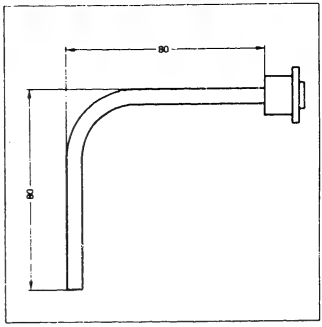


Figure 4 Modify pipe bend

4. Reassembling the connecting parts

Assemble in the order given under 1, e.g. connect the hose which leads to item 6 with the pipe bend and insert it in the hole prepared; secure with the countersunk-head screws.
Items 5 and 6 in accordance with 1.
Blank off the holes on the upper side with appropriate cover plates.

5. Remove and replace the flywheel

The flywheel is secured to the drive shaft with hexagon-head screw, washer and keyway.
After removing the multi-plate clutch, unscrew the hexagon-head screw and pull off the old flywheel.
The new flywheel is fitted in the reverse order. Check for true running (maximum deviation: 0.03 mm).

After-sales Service

Technical Bulletin

PRESSURE GAUGE AND SETTING RESTRICTION

for testing the manifold-pressure compensator (LDA)

VDT-I-420/100 En
11.1980
Supersedes Ed. 9.1974

The following pressure gauge is specified in the Test Instructions VDT-WPP 001/4, Supplements 7 and 8 for testing and setting the LDA:

Pressure gauge: 0 ... 1.6 kgf/cm²
Quality grade: 1.0
Scale division: 0.05
(i.e. Wika-No. 4184)

This pressure gauge can be ordered directly from

Hans Wittig Co.
Vogelsangstraße 15
D-7000 Stuttgart 1

This pressure gauge is also to be used for setting all LDA's or smoke limiters whether of older or more modern design.

Please order directly from the firm given above; the pressure gauges will be dispatched to you directly. In case of difficulties, you can also send your order to KH/VKD4.

The setting restriction listed in the Test Instructions (without vacuum gauge) has been allocated a new part number. It is still to be ordered in the usual way.

Part number (without vacuum gauge): 1 688 130 132

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

After-sales Service

Technical Bulletin

TEST SHEET FOR FUEL INJECTION PUMPS — VDT-I-Gen. 053 En

Instructions for use in after-sales service — 10.1982

Testing and adjusting specifications in test sheets give the customer the values that specialists have stipulated for his fuel-injection assembly and they can be referred to again at a later stage if required.

Great importance is attached to the documentation of testing and adjusting specifications not only as evidence in guarantee cases, but also in individual cases of quality control.

The test sheet is an important item in the quality work of the Bosch after-sales service centers and will be introduced immediately to the after-sales service organization and is to be prescribed for use (example see over).

Application

The test sheet for fuel-injection pumps must be drawn up for all testing and adjusting work carried out on the injection-pump test bench for commercial customers (e.g. vehicle representative organizations, authorities, forwarding agents). The test sheet may also be drawn up and handed in for private customers.

In the case of guarantee claims on injection pumps, providing these concern testing and/or adjusting values, a test sheet should be kept with the guarantee claim form in every case.

The signature of the workshop manager confirms that the vehicle to be tested was in fact tested with the test equipment prescribed by Bosch and that the relevant test regulations were adhered to.

The test sheet (1 pad = 50 duplicating sets) can be ordered in the usual manner by quoting publication no. VDT-W-400/308.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

Test sheet for fuel-injection pumps

VDT-W-400/308-1 En

BOSCH DIENST BOSCH SERVICE

Customer ..... Order no .....

Pump ..... Assembly no ..... Tested on .....

Governor ..... Series no ..... by .....

E = Measurement when received, A = Measurement when adjusted

Prestroke E ..... mm at ..... mm RT Cam sequence .....

A ..... mm Angular cam spacing E ..... °camshaft

A ..... °camshaft

Delivery quantity	n min⁻¹	RT mm	LDA p bar		Delivery quantity (FM) cylinder (cm³/1000 strokes) 1	2	3	4	5	6	7	8	9	10	11	12	FM scattering
Full load				E													
				A													
Delivery characteristics				E													
				A													
				E													
				A													
				E													
				A													
Idle				E													
				A													
Start				E													
				A													

Breakaway	E	at	min⁻¹	mm RT less than at full load					torque-control travel		mm RT
	A	at	min⁻¹	mm RT less than at full load					torque-control travel		mm RT
Manifold-pressure compensator (LDA)	E	at	bar	mm RT	at	bar	mm RT	at	bar		mm RT
	A	at	bar	mm RT	at	bar	mm RT	at	bar		mm RT

Distributor-type fuel-injection pump

FM = Delivery quantity RT = Control-rod travel

Timing-device travel	E	at	min⁻¹	mm	at	min⁻¹	mm	at	min⁻¹		mm
	A	at	min⁻¹	mm	at	min⁻¹	mm	at	min⁻¹		mm
Supply-pump pressure	E	at	min⁻¹	bar	at	min⁻¹	bar	at	min⁻¹		bar
	A	at	min⁻¹	bar	at	min⁻¹	bar	at	min⁻¹		bar
Overflow quantity	E	at	min⁻¹	cm³/10s				at	min⁻¹		cm³/10s
	A	at	min⁻¹	cm³/10s				at	min⁻¹		cm³/10s
Breakaway	E	at		min⁻¹	cm³/1000 strokes						
	A	at		min⁻¹	cm³/1000 strokes						

Judgment/remarks:

Date, signature of examiner

Company stamp Signature of workshop manager

BOSCH

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After-sales Service

Technical Bulletin

TELEPHONE ENQUIRIES ABOUT TEST SPECIFICATIONS FOR INJECTION PUMPS

VDT-I-Gen. 057 En
3.1983

040 ..
041 ..
042 ..
046 ..

There has recently been a considerable increase in enquiries and demands for test specifications for fuel-injection pumps and governors. The following regulation has therefore been introduced and will apply until further notice:

1. Enquiries about test specifications can be directed to KH, VSK in Wernau, Tel: 07153/63-623 (automatic telephone answering service).

2. Experience has shown that answering enquiries with the cooperation of various departments often takes several hours. Answers to enquiries can therefore be made at the earliest during the afternoon of the day in question.

This time delay must be taken into account especially when a fuel-injection pump is being timed again after repair work. It would therefore be of considerable assistance if a check could be made before each period of repair work, to see if the test specifications are in the microcards. If they are missing, they can then be ordered immediately.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

Technical Bulletin

40...46, 58

SETTING OF PORT CLOSING

VDT-I-400/113 En
3.1984

EP-combinations 0 402 848 ..
using the fuel-injection pumps

PESV 8 P 90/320 LS 5 ·	Fitted in MAN engines of the
.. LS 11	model range D 2858/M1, D 2658
.. LS 11 Z	M 2, D 2658 M 20, D 2658 M 23
.. LS 13	and D 2658 M 4

Up till now, the port closing adjustment on engines with an 8-cylinder, P-type pump (2 cylinder banks in "V" form) has led to leaks and maladjustment of the delivery quantity on pump-cylinder 1. This was due to the fact that the deliveryvalve holder of pump cylinder 1 (seen looking from the pump drive, 1st cylinder on the right) had to be unscrewed and the flange bushing turned with it. This fault has been reported from workshops and from MAN operators.

If it is necessary, for any reason whatsoever, for one of the above-named pumps to be removed in your workshops or at a MAN operator, it is necessary for you to carry out the following jobs in order to ensure perfect timing of the pump to the engine:

1. Check the uniformity of fuel delivery at rated speed in accordance with the test specifications. Observe cylinder 1.

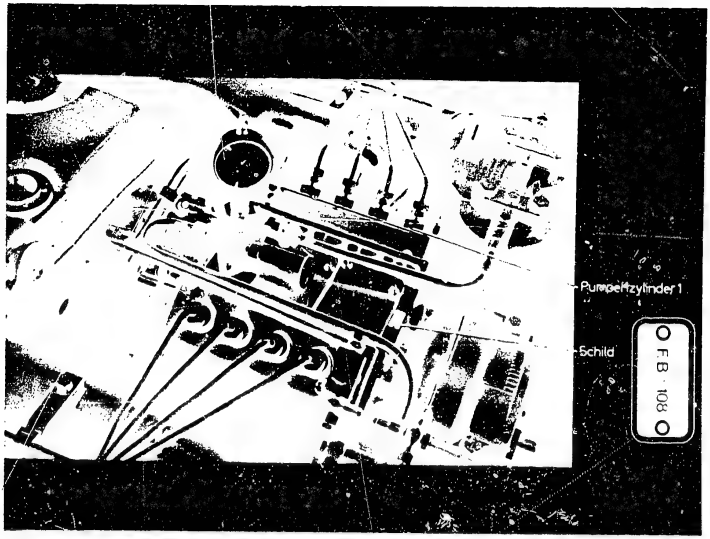
2. Connect the port-closing measuring device 1 688 130 085 - EFEP 388 A together with the appropriate dial indicator to pump cylinder 1.

3. Unscrew the upper screw plug 2 443 462 014 et the supply pump (30 mm A/F), and replace it with the modified screw plug with inner thread. This screw plug is comprised of the following parts:

2 442 462 023	Screw plug with inner thread
2 443 462 024	Plug screw for screw plug
2 916 710 607	Flat seal ring

Now screw the holder 1 688 130 044 - EFEP 466 into the internal thread of the screw plug, use a seal ring. Depending upon the particular dial indicator, it may be necessary to lengthen the measuring stem. The important thing is that the stem is long enough, with the dial indicator fitted, to reach the base circle of the supply-pump camshaft with ease i.e. it must be possible to set the dial indicator to "0" as detailed under Para. 4 (refer to Fig.).

4. Turn the camshaft in the normal direction of rotation and, when the supply-pump cahshaft is in the BDC position, set the dial indicator to "0".



5. Check the plunger lift to port closing (refer to Test Specification Sheet). Here, at the position "start of delivery (FB), pump cylinder 1", the value read-off on the dial indicator mounted on the supply pump is to be stamped-in on a special plate in hundredths of a millimeter. This special plate, Part Number 1 901 102 005, is to be attached to the upper side of the pump housing (seen looking at the drive end) after the "Start of delivery (FB)" data has been stamped-in. It is to be fastened using 2 grooved drive studs (2 917 725 031), the numbers must be legible from the governor side (see Fig.).

Caution:

The pump is to be checked on the test bench as follows before the "start of delivery (FB)" data is stamped into the plate 1 901 102 005.

The work as detailed in Paras. 4 and 5 for determining the start of delivery, with the dial indicator on the supply pump, must be repeated a numer of times with this pump type. The FB figure which has been determined must be reached again without any doubt in the following checks. Between each check, the pump must be run briefly at its rated speed (n_p = 1000 min^{-1}).

If the readings taken during these checks differ each time by more than 0.03 mm compared to the previously taken measurement, this means that the roller of the roller tappet in the pump housing must be changed. This is carried out as follows:

- Remove the fuel supply pump
- Remove the governor cover, the flyweight assembly and the governor housing.

  Caution!
  Pay attention to the shims for camshaft play in the governor housing.

- Unscrew the tappet-guide screw and pull out the supply-pump roller tappet 2 418 750 005.
- Remove the tab washers 2 411 290 001 (for the roller) and replace the roller 2 410 202 009.

Reassembly is to take place in the reverse order.

After changing the roller in the roller tappet, the start of delivery figure must be determined again and stamped into the plate 1 901 102 005.

If for any reason at all, the supply pump is replaced, it is imperative that the start of delivery dimension is checked again. If it has changed, the new figure is to be stamped into the palte. If the supply pump is replaced in the vehicle, this check can be carried out using the port-closing setting device KDEP K 200, or the high-pressure hand pump 1 687 222 048.

Up till now, the out-of-round of the roller tappet has not been taken into consideration and the start of delivery has not been checked and marked on the pump. This means that a possibility must now be created in order to differentiate between the various pumps. The start of delivery figures which have been stamped into the plate as a result of this Technical Bulletin must therefore be clearly and legibly underlined.

The fuel-injection pumps concerned must be checked for correct setting in accordance with the Test Specification Sheet after the above checks have been completed.

6. In those cases in which the uniformity of delivery and the pre-stroke are both OK, i.e. with new pumps, the start of delivery dimension can be ascertained using the high-pressure hand pump EFEP 453 B - 1 687 222 048, or the port-closing setting device KDEP K 200, using the familiar high-pressure overflow method.
   Under no circumstances whatsoever are any of the delivery-valve holders to be loosened or unscrewed.

   The start of delivery dimension ascertained in this manner wil be used in future as the reference point. For this reason, utmost care must be exercised when carrying out this step. If necessary, it is to be repeated.

This work is to be carried out free-of-charge for the customer, and is completely independent of warranty regulations which may have been applicable.

The warranty reporting and the warranty procedure for reimbursement for the work carried out, and material used, is to be as follows:

Outside Germany: The RG and AV are requested to credit 1 1/2h (15 AW) on the collective warranty report for the work performed. This Technical Bulletin is to be quoted.

Please direct questions and comments concerning the contents to our authorized representative in your country.

After-sales Service

Technical Bulletin

40...46, 58

VDT-I-420/115 En

3.1984

Supersedes VDT-I-DAF 004

NOTES ON TESTING

ADJUSTING THE MANIFOLD-PRESSURE COMPENSATOR (LDA) ON THE FUEL INJECTION PUMP COMBINATIONS OF DAF-ENGINES DT 615, DF 615, DU 825

On the fuel-injection pump combinations as given above, the full-load deliveries are set as follows:

Remove the LDA and carry out the basic setting of the pump according to Section A, and of the governor according to Section B of the Test Specifications.

Fit the LDA

Set the full-load quantity (with charge-air pressure) using the full-load stop screw (3) in the housing of the manifold-pressure compensator.

At the speed given in the Test Specifications, set the manifold-pressure travel at the guide bushing of the helical spring (1) (spring seat).

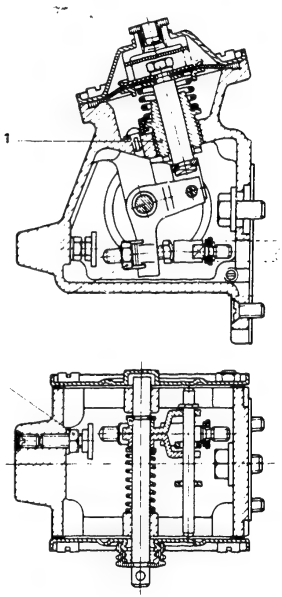
Using the bell crank (2) of the manifold-pressure compensator, set the full-load delivery at 0 bar.

Set 0.2...0.3 mm more control-rod travel at the fuel-delivery stop screw in the governor than is the case with charge-air pressure.

1 = Spring pre-tension (start and end of LDA travel)

2 = Setting (without charge-air pressure)

3 = Setting (with charge-air pressure)



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BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

Technical Bulletin

40...46, 58

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6.1984

SETTING THE FUEL DELIVERY
ON IN-LINE INJECTION PUMPS OF SIZE P,
MOUNTED ON SCANIA ENGINES

To achieve increased or reduced power outputs, Scania is readjusting the full-load deliveries on in-line injection pumps of size P mounted on engines of series D 8, DS 8, D 11, DS 11, D 14, DS 14.

The pumps are marked by an additional letter after the type designation of the pump and in some cases after the assembly part number. When changed, the corresponding test specifications will refer to this Technical Bulletin.

As of a power output of 85 .. and lower it is not necessary to adjust the manifold-pressure compensator. The fuel deliveries given in the tables were compiled using Saab-Scania documentation.

The reduced power outputs for engine D 11 are listed on test-specification sheet SCA 11.0 n. The test specifications for the power output versions of series D 14 and DS(C) 14 are published on individual test-specification sheets.

Engine	Pump	Governor
D 8	PE 6 P 110A 720 RS 261	RQV...170R, EP/RSV..310 R

Pump S 261..	Output %	Delivery in cm^3/1000 ($\pm$ 1.0) at engine speed ..min^{-1}				Change of control-rod travel for change of full load
		1200	900	750	600	
X	95	84	81	78	72	- 0.7 mm
Z	90	80	75	71	64	- 1.2 mm
N	85	76	70	64	55	- 1.7 mm
M	80	71	63	57	48	- 2.3 mm
L	75	66	57	52	43	- 2.8 mm
K	70	60	52	46	37	- 3.3 mm
J	65	56	49	44	34	- 3.6 mm
I	60	51	46	41	31	- 3.9 mm

The test specifications apply to calibrating oil to ISO - 4113.

Engine	Pump	Governor
DS 8	PE6P110A720 RS 3012 PE6P110A720 RS 3013	RQV .. 275 R EP/RSV .. 310 R
	PE6P110A720 RS 3034 PE6P110A720 RS 3035	RQV .. 275 R EP/RSV .. 310 R

Pump S ..	Output %	Delivery in cm³/1000 (± 1.0) at engine speed ..min⁻¹				Change of control-rod travel for change of full load
		1200	900	750	600	
T	103	121	118	118	118	+ 0.3 mm
S	98	113	109	108	107	- 0.2 mm
X	95	109	105	102	101	- 0.5 mm
Q	93	106	102	99	97	- 0.7 mm
Z	90	102	98	94	91	- 1.0 mm
O	88	100	95	91	86	- 1.2 mm
N	85	96	92	87	80	- 1.5 mm
M	80	91	86	80	69	- 1.9 mm
L	75	86	81	74	60	- 2.3 mm
K	70	80	74	66	51	- 2.8 mm
J	65	77	71	63	46	- 3.1 mm
I	60	73	67	58	41	- 3.5 mm

The test specifications apply to calibrating oil to ISO-4113.

Engine	Pump	Governor
DS 11	PE6P110A720RS3006 PE6P110A720RS3016 PE6P110A720RS3014	RQV .. 242 R EP/RSV..310 R EP/RSV..310 R

Pump S ..	Output %	Delivery in cm³/1000 (± 1.0) at engine speed ..min⁻¹ 1100	900	750	600	Change of control-rod travel for change of full load
P	120	198	202	202	204	+ 2.1 mm
U	115	188	189	188	192	+ 1.6 mm
R	113	183	185	184	187	+ 1.4 mm
W	110	178	178	178	181	+ 1.0 mm
V	108	175	175	174	177	+ 0.8 mm (Case - USA)
Y	105	170	170	169	171	+ 0.5 mm
T	103	168	167	166	167	+ 0.3 mm
S	98	158	159	158	159	- 0.2 mm
X	95	152	154	153	154	- 0.4 mm
Q	93	148	151	150	150	- 0.6 mm
Z	90	143	146	146	146	- 0.8 mm
O	88	139	142	142	142	- 1.0 mm
N	85	133	134	136	135	- 1.3 mm
M	80	124	125	127	126	- 1.7 mm
L	75	116	115	117	114	- 2.1 mm
K	70	108	106	105	102	- 2.5 mm
J	65	101	97	96	92	- 2.9 mm
I	60	94	90	88	85	- 3.4 mm

The test specifications apply to calibrating oil to ISO-4113.

Engine	Pump	Governor
DS 11	PE 6 P 100 A 720 RS 202 PE 6 P 100 A 720 RS 203	RQV..167R, 168 R EP/RSV..310 R

Pump S ..	Output	Delivery in cm³/1000 (± 1.0) at engine speed ..min⁻¹				Change of control-rod travel for change of full load
		1100	900	750	600	
W *	110	176	179	181	182	+ 0.9 mm
V *	108	172	174	176	176	+ 0.7 mm
Y *	105	168	170	172	171	+ 0.5 mm
T	103	165	166	168	164	+ 0.3 mm
S	98	156	157	157	152	- 0.2 mm
X	95	151	152	152	147	- 0.5 mm
Q	93	147	148	148	143	- 0.7 mm
Z	90	142	143	142	137	- 1.0 mm
O	88	138	139	137	133	- 1.2 mm
N	85	133	135	132	127	- 1.6 mm
M	80	124	125	122	116	- 2.1 mm
L	75	114	115	111	104	- 2.7 mm
K	70	104	105	100	93	- 3.2 mm
J	65	97	96	90	83	- 3.7 mm
I	60	89	86	80	73	- 4.3 mm

* Start of delivery on these versions with prestroke = 2.4 .. 2.5 mm as of BDC

The test specifications apply to calibrating oil to ISO-4113.

Note:

Setting of the injection-pump assemblies is permissible only in accordance with the pump designation and/or marking.

Use only the latest, valid test specifications on microfiche WP.. . Other injected fuel quantities may lead to engine damage and therefore to claims for damages from owners of engines and vehicles.

When replacements are ordered for complete injection-pump assemblies, we deliver only the assembly with the basic setting. This means that, when replacing a marked injection pump, you must perform the appropriate fuel-delivery setting and marking.

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